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Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

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Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

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83 ECONOMICS AND COST ANALYSIS 2608
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2608
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2608
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2609
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2610
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2610
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 2612
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2614
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 2614

Note: N.A. means that no abstracts were assigned to this category for this issue.

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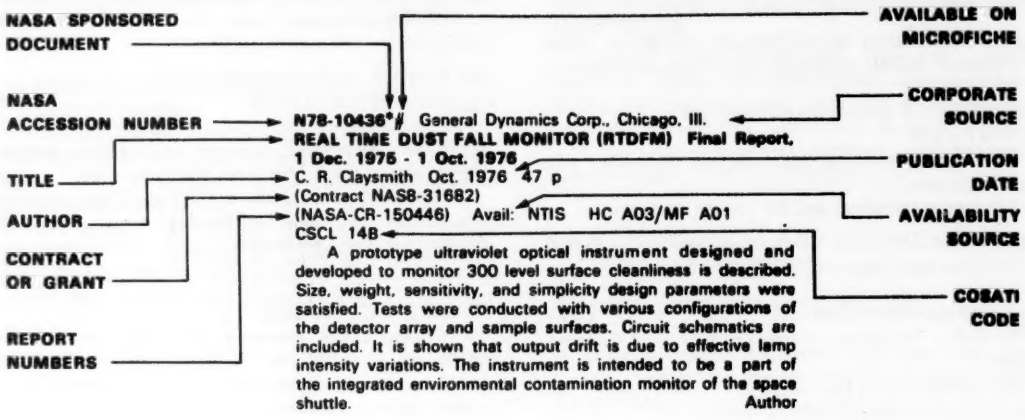
TYPICAL CITATION AND ABSTRACT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N78-10436*# General Dynamics Corp., Chicago, Ill.
REAL TIME DUST FALL MONITOR (RTDFM) Final Report, 1 Dec. 1975 - 1 Oct. 1976
C. R. Claysmith Oct. 1976 47 p
(Contract NAS8-31682)
(NASA-CR-150446) Avail: NTIS HC A03/MF A01
CSCL 14B
A prototype ultraviolet optical instrument designed and developed to monitor 300 level surface cleanliness is described. Size, weight, sensitivity, and simplicity design parameters were satisfied. Tests were conducted with various configurations of the detector array and sample surfaces. Circuit schematics are included. It is shown that output drift is due to effective lamp intensity variations. The instrument is intended to be a part of the integrated environmental contamination monitor of the space shuttle.
Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects— not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, X-RAY FLUORESCENCE STUDY
UNKNOWN, Science Applications Inc., *La Jolla, California* 92037 (FA77WA-3963; FA160250 (TRAIS NO.))

A review will be directed to the application of X-ray sources in the X-ray fluorescence (XRF) detection of tagged or ordinary explosives. Review and determine (1) the distribution in composition and type of blasting caps and other explosives and (2) the characteristics of possible or suggested taggants, including at least lead, uranium and rare earth elements.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0002, INTERACTIVE COMPOSITE JOINT DESIGN
M.K. SMITH, McDonnell Douglas Astro. Co., *Long Beach, California* (DF136140; F33615-76-C-3058)

Working in an interactive mode with digital computers has been shown to drastically reduce elapsed time for iterative type solutions and reduce human errors. The design of composite joints is normally an interactive problem, where it is necessary to review geometrics, materials, and internal load and stresses of candidate designs to optimize design details. The objective of this program is to improve the design capability for joints and stress concentrations in composite aircraft structures by exploiting the interactive communication with digital computers. The most critical design problem in composite aircraft structures is that of the stress concentrations at joints and cutouts.

An in-depth investigation will be made of the use of interactive computer operation and computer graphics to facilitate the design of composite structures at stress concentrations. Double-lap, single-lap, scarf and stepped-lap bonded and bolted joints will be considered.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, DETERMINE FEASIBILITY TRADE-OFFS AND COST-EFFECTIVENESS OF AIRBORNE TIRE PRESSURE INDICATING (TPI) SYSTEMS
UNKNOWN, McDonnell Douglas Corporation, *Long Beach, California* 90808 (FA77WA-4070; FA160424 (TRAIS NO.))

The cost, weight, functional features, and service experience of available airborne type tire pressure indicating systems (TPI) shall be determined. The adaptability of each candidate system to production and in service aircraft shall be evaluated. The cost of installing the candidate systems on various types of air carrier jet transports in service shall be estimated. This data shall be tabulated for comparison and evaluation. Manufacturers names shall be coded to prevent implications of rankings.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0004, AIRCRAFT DESIGN - TRANSONIC AREA RULE
M. HAFEZ, Flow Industries Incorporated, *Los Angeles, California* 90045 (DN675530; N00014-76-C-0880)

The recently developed transonic area rule with lift is becoming an extremely important tool for the design of aircraft configurations. The proposed investigation will explore, theoretically, the range of validity of the area rule in terms of such parameters as: Mach number, angle of attack, thickness ratio and the sweep for representative aircraft configurations.

The power of the area rule for design is that it masks out details which, in an asymptotic sense, do not contribute significantly to the structure of the transonic flow field. The theory provides, relatively simply, the global characteristics of the configuration. In order to assess the range of validity of the theory as non-asymptotic deviations become more pronounced, more exact numerical calculations will be made for a range of configuration parameters and compared with the area rule predictions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0005, AIRPORT AIRSPACE DELAY MODEL PLANNING AND ANALYSIS
S. FLOYD, S R I International, *Menlo Park, California* 94025 (FA77WA-4033; FA160439 (TRAIS NO.))

The contractor shall provide the personnel, facilities, equipment, and services necessary to perform the technical effort set forth hereafter referred to as Airport/Airspace Delay Model Planning and Analysis. The purpose of this effort is to develop methods and techniques for examining the capacity and delay of the airspace systems associated with the task forces' studies of the following eight airports and to apply the methods at a task force location: (1) John F. Kennedy (2) La Guardia (3) O'Hare (4) Denver (5) Atlanta (6) Miami (7) Los Angeles (8) San Francisco.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0006, SENSITIVITY OF OPTIMIZED STRUCTURES
B.O. ALMROTH, Lockheed Aircraft Corporation, *Palo Alto, California* 94304 (DF136890; F33615-76-C-3105)

Stability of structural components is one of the most important considerations in airframe design. It is known that the structural components which are critical in buckling are sensitive to initial geometric deviations. The presence of initial deviations reduces the buckling load of the structures. In the case of optimized structures the effect of the initial imperfection is seriously enhanced. The purpose of this effort is to develop a method to study this effect.

A finite element or other numerical method will be used to study the response of optimized structures with initial geometric deviations. different structural configurations will be investigated to determine the sensitivity of each configuration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0007, AERODYNAMICALLY GENERATED SOUND AND SUBSONIC AERODYNAMICS
H.S. RIBNER, Univ. of Toronto, *Toronto, Ontario, Canada* (DF001050; AF-AFOSR-2808-75)

AF function - advanced aerospace vehicles. Deficiency - lack of understanding of the basic physical mechanisms which produce noise in propulsion systems representative of current and future Air Force aircraft. Objective - examine two of the key physical phenomena associated with high-performance jet engine noise (viz jet exhaust and combustion). How research contributes - understanding of the phenomena will enable the Air Force to remove, or at least suppress, the amount of noise associated with operation of jet aircraft.

An experimental and theoretical investigation on jet noise will be undertaken. Documentation of the relative shear/self contributions by cross-correlating the flow signals with the far field sound signal will be done via a laser-Doppler system. Work on usefulness of a refractive barrier as a jet noise suppressor will be continued.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0008, CONCORDE SONIC BOOM

L. MACHTA, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (RAC44676)

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin., Systems Research & Development Service

1.0009, STUDY STANDARD AIR CARRIER DELAY REPORTING SYSTEM

UNKNOWN, Eastern Airlines Incorporated, *Miami, Florida* (FA77WA-4029; FA160370 (TRAIS NO.))

The development of standards for measuring, compiling, and publishing air carrier reported delays and delay cost statistics. Track airport and Air Traffic Control (ATC) system performance for future system delay forecasting. The final report required hereunder shall also provide a basis for determining the cost of delays in terms of fuel usage.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0010, DEVELOPMENT OF COMPUTER-GENERATED PHENOGRAMS TO FORECAST REGIONAL CONDITIONS HAZARDOUS TO LOW-FLYING AIRCRAFT

W.E. SOUTHERN, Northern Illinois University, School of Liberal Arts & Sci., *Dekalb, Illinois* 60115 (DF049880; AF-AFOSR-3431-77)

AF function - bird strikes continue to pose a major hazard to aviation, especially to high-speed, low-altitude aircraft. The cost of bird strikes in civilian and military aviation vastly exceeds that of any agricultural or other economic problem created by birds. Deficiency - military aircraft often fly at low altitudes and at high speeds to avoid radar detection. Bird concentrations by non-migratory species are relatively easier to anticipate than migrating species and thus certain precautionary measures can be taken. Migrant species are not present during all seasons but may be locally abundant near air bases or within flight lanes during specific months. Objective - to accurately depict the seasonal range of each of 20 species of gulls and terns common to the United States and to relate this information to the location of Air Force bases, to describe the monthly schedule and density of larid migration. Weekly analyses will be provided for air bases having a high potential for bird/aircraft problems, to ascertain the population density for gulls and terns in each region of the United States during each month, to determine the geographic origin of gulls responsible for hazards to aircraft at specific bases, mm to provide a quantitative basis for assessing hazards levels at various locations. How research contributes - this research will support research objectives contained in subarea 1.8, 'Biological Contributions to Air Force Effectiveness'.

Band encounter data for gulls will be analyzed by a FORTRAN program that sorts data into any of 12 categories and plots encounter sites on overlay maps of North America. Information obtained from several sources will be used to prepare phenograms that can serve as an advance warning system for flight officers and/or pilots. Prior to flights it will be possible to recognize possible hazardous areas, to determine the extent of the risk, to select alternate routes if necessary, and to know the approximate duration of dangerous bird concentrations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0011, DEVELOPMENT OF CAST CARCASS TIRES FOR MILITARY AIRCRAFT

E.J. GEORGIA, Zedron Incorporated, *Baltimore, Maryland* (DF132480; F33615-76-C-3062)

Military aircraft tires are presently fabricated from a multiplicity of components assembled by essentially a manual operation which results in high tire cost. The objective of this work unit is to develop a castable replaceable tread aircraft tire from thermosetting polymers which can be fabricated with a minimum of manual labor and will result in a significant reduction of military aircraft tire cost.

This effort consists of two parts: development of a completely cast, one-piece aircraft tire and development of a two-piece cast carcass/replaceable tread aircraft tire. The effort may be awarded to single or dual contractor(s). The prototype tires developed in this effort will be 7.00-8/16 pr type III size. This size tire is used on the A-37 aircraft. The one-piece tire and the carcass of the two-piece tire will be cast or molded from high-strength elastomers in machinery common to the plastics industry. The replaceable belt of the two-piece tire will be fabricated from conventional rubber compounds with reinforcing cords. The entire effort will be broken into three phases- materials evaluation, multiple iterations of prototype tire designs, and design refinement of the most promising prototype concept. This last phase will also consist of a plan for fabrication of tires suitable for flight test.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0012, DISPERSED AND RECONFIGURABLE DIGITAL FLIGHT CONTROL SYSTEM STUDY

J. BOUDREAU, Grumman Corporation, *Bethpage, New York* 11714 (DF139720; F33615-77-C-3041)

Development of strategies to increase aircraft survivability by dispersing and/or reconfiguring the flight control system. The development of strategies for dispersion of sensors, computers, and surfaces, and the reconfiguration of the flight control system by switching of sensors, surfaces, or computers should reduce the total number of components required to perform the flight control function, reduce the logistics cost in maintaining flight control systems, and significantly increase the survivability of military aircraft.

Analyze the dispersion of sensors about the airframe with appropriate structural filtering. Compare the use of multiple control surfaces to perform the flight control functions with the use of multiple actuators on single surfaces. Analyze the advantages of dispersing micro-processors about the airframe. Compare the use of a central processing computer with dispersed and non-dispersed micro-processors for synchronization, monitoring of failures, and size required. Develop reconfiguration strategies for detectable sensor failures, surface failures, and computer failures. Determine how to isolate where the failure occurred and what mode of reconfiguration to use (i.e.), switch the bad unit out, switch to a redundant unit, approximate the function using other non-redundant units, or switch to a back-up mode.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0013, COMPRESSIBLE AIRFOIL DESIGN METHODOLOGY

G.M. GREGOREK, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DF140070; AF-AFOSR-3273-77)

This work unit supports the development of advanced USAF high-altitude, long-endurance aircraft. Presently, high-altitude, long-endurance aircraft used for military missions are limited in altitude and payload capability. Advanced technology airfoils will help alleviate these lifting surface associated problems. This work

effort is the development of a compressible subcritical airfoil design method which will be used to configure airfoils for future USAF aircraft. Use of these new technology airfoils will permit flight envelope expansion on future military high-altitude, long-endurance air vehicles.

An existing incompressible inverse airfoil design procedure will be coupled with compressibility corrections to produce an accurate subcritical airfoil design method. Serveral airfoils applicable to high-altitude, long-endurance aircraft will be developed using this method. The developed airfoils will be checked with proven analysis procedures to verify the new airfoil designs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, ADVANCED TRANSONIC AIRFOIL INVESTIGATION INCLUDING WALL AND SCALE EFFECTS

J. LEE, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DF135630; F33615-76-C-3001)

Current USAF air superiority fighter designs indicate that an important portion of the aircraft's flight time will be spent maneuvering under high lift conditions in the transonic regime. Analytical research is presently being conducted on advanced transonic airfoils for use on these aircraft. In order to obtain valid empirical data from wind tunnel tests of these advanced airfoils, flow conditions should approach more closely than in the past those of free flight. Previously, wind tunnels could not achieve free flight conditions due to the influence of the wall and Reynolds numbers effects. With the advent of the OSU 6 inch by 22 inch transonic wind tunnel, which has reduced wall effects, it has become possible to simulate a range of Reynolds numbers on the order of those encountered in free flight for acceptable test times. With this facility it becomes possible to separate wall and Reynolds number effects thereby decreasing time to obtain valid data and enabling rapid development of advanced transonic airfoils.

Two advanced transonic airfoil configurations will be tested in the OSU 6x22in. transonic wind tunnel for various test conditions (i.e., several Mach numbers, angles-of-attack and Reynolds numbers). Since wall effects are expected to be small due to the comparatively large distance between the walls and model, it should be possible to quantify Reynolds number effects on the pressure distribution over the airfoil. In addition to the pressure data on the walls and models fast response probes will define flow detail (e.g., boundary layer).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, ROTOR FLOW FIELD RESEARCH IN LOW-SPEED HELICOPTER FLIGHT 14142-EX

H.R. VELKOFF, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DA0E9182; DAAG29 76 G0260)

To experimentally examine and define representative flows past rotors and rotors-fuselage-empennage configurations which model a helicopter in a transitional flight regime. This research investigation is highly relevant to on-going research at AMRDL in rotor aerodynamic environments characteristic of NOE operations and hence will impact the technological requirements of improved airfoil design, performance, dynamics and handling qualities.

Model rotors, fuselages, and empennages will be designed, fabricated and put in a small wind tunnel and tests will be performed which consist of measurement of velocity distributions in the wake as well as flow visualization to define the characteristics of the flow peculiar to rotors in low advance ratio flight regimes.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0016, PERFORMANCE INVESTIGATIONS OF ADVANCED FLIGHT VEHICLES

B.R. BENSON, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF138530)

Mission requirements can impose performance levels difficult or impossible to achieve within today's technology. New concepts or approaches are constantly being evaluated and analyzed to assess their payoff not only in performance enhancement but the impact on cost. The objective of this effort is to investigate new concepts and technologies to assess the overall payoff for future vehicle application.

This will be an analytical performance analysis consisting of several elements. The first element will explore the aerodynamic potential in missile design. The relation between performance parameters and aerodynamic characteristics for missiles will be developed and the importance of the aerodynamic factor established. The second element will be to establish the rationale for supersonic cruise capability in a fighter and the third element will be exploration of future missile concepts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, NEW STRATEGIC AIRLIFT CONCEPTS

S.L. BROWN, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF136750)

There will be a definite need within the next 15 years to augment our strategic logistics fleet as well as update our aerial tanker capability. In view of the preceding, this effort will establish the mission utility of very large military aircraft and then assess and promote the advanced technologies which are relevant to future system development of very large military aircraft. The objective of the effort is to assess the relevant advanced technologies, conduct design trade-off studies and evaluate the system effectiveness of very large military aircraft. The ultimate result of this program will be reduced risk and cost when a specific very large military aircraft reaches the system acquisition phase.

Advanced technologies with application to very large military aircraft will be identified by the technology divisions (flight mechanics, flight control, structures, vehicle equipment and vehicle dynamics). Design data and relative state of advancement for each technology will be provided for incorporation in in-house design studies. These studies will identify the high leverage technologies and critical mission areas for further investigations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, MILITARY AIRCRAFT DESIGN METHODOLOGY

J.L. FOLCK, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF129020)

In support of the laboratory's aircraft design activities, mathematical and computational methods, incorporating man in the loop where appropriate, are needed for the rapid and accurate definition, analysis, design, and evaluation of flight vehicle systems. Vehicle preliminary design analysis will be achieved primarily by collecting and integrating a variety of methods, programs, and computer graphics hardware into a faster, more accurate, and interactive design synthesis computer program. These techniques will be sufficiently developed to analyze a complete flight vehicle design for a specified mission within a few days, instead of requiring several weeks. The ultimate objective is to make high-speed computing power readily and easily accessible to the designer without requiring him to be familiar with the details of programming and computer hardware.

The approach is to develop and acquire the graphics software and hardware required for a designer to communicate with a large design/analysis program (CASP) via a local graphics console to define the vehicle mission and geometry. Existing, more accurate aerodynamics and mission analysis modules will be modified for inclusion in the CASP program. Methodology for assessing the impact of emerging technologies will be required and incorporated into the CASP program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, FIGHTER TIRE PERFORMANCE EVALUATION

J.R. HAMPTON, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF140880)

This effort supports the development of tire design, performance and laboratory test criteria/techniques and the develop-

ment of new and improved tires for Air Force aircraft. Presently, tires are the highest single hardware grouping logistics and maintenance cost incurred for Air Force aircraft. Reduced aircraft all weather operation capability and aircraft ground accidents are attributable to tire traction limitations. The objectives of this effort are to develop tire design and performance criteria, tire laboratory quality control and qualification test techniques, and to laboratory test and evaluate new tire designs. Accomplishment of these objectives will result in improving Air Force aircraft ground performance and reliability, and reduce Air Force logistics costs.

Unique tire test equipment located in the affdl landing gear test facility will be used to establish tire force and moment properties at various loads and deflections under static, rolling and braking conditions. New tire test techniques will be developed, and verified by laboratory test and comparison with in-service data. A-37 aircraft size one-piece cast and two-piece cast carcass replaceable tread tires will be subjected to the full spectrum of laboratory qualification tests, and tests to establish tire mechanical properties. Technology transfer will be accomplished by the preparation of test reports for grouping of tires subjected to the same test(s), a handbook of tire mechanical properties, and individual technical reports covering new tire test techniques and cast-cast carcass tire tests.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, STABILITY AND CONTROL FLIGHT RESEARCH ANALYSIS AND DATA CORRELATION

S.F. LASH, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF133450)

At present the level of accuracy is not well known of the present analytical methods (theoretical, semiempirical and wind tunnel test) used in the development of an aircraft for predicting its full-scale flight characteristics. This knowledge is required to better design future weapons systems. The objective of this program is to determine the degree of correlation existing in the area of stability, control and handling characteristics as extracted from flight data with the characteristics as predicted using present state-of-the-art analytical methods and test procedures.

The approach to this problem is to extract a consistent and repeatable set of stability derivatives and handling qualities parameters from flight test data on a variable sweep aircraft. These data will be correlated with predicted characteristics as derived using (1) analysis incorporating wind tunnel data from models having both rigid and aeroelastic wings and (2) from analytical methods employing theoretical and/or semiempirical estimates.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0021, SURVIVABLE AIRCRAFT TRANSPARENT ENCLOSURES

E.O. ROBERTS, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF140230)

The work unit supports the development of fighter aircraft to survive the anticipated operational environment including hostile threats for laser weapons, nuclear EMP and thermal shock, fragments from high-energy missile warheads and conventional small arms fire and the natural induced environment of high temperatures. Detailed aircraft specifications, design requirements, design criteria and even general guidelines do not currently exist for aircraft transparencies. The objective of this effort is to define the design requirements for a near-term aircraft transparency system. Current development activity exists for the re-design and retrofit of various USAF aircraft transparency systems to survive their respective environments. Early analysis and study to develop preliminary development guidelines will result in a considerable savings not only in acquisition costs but also logistic support costs. This early activity will also establish the operational performance parameters that effect the design of transparencies so that preliminary analyses and trade studies can be performed more effectively.

The approach is to review existing air-to-surface (ATS) and other documentation to determine the near-term fighter system requirements and desired transparency performance capabilities. A literature survey will be conducted to gather information on existing system transparencies. test criteria will be extracted from current system transparencies to determine effects of specific requirements. Trade studies will be accomplished to determine the optimum design and test requirements/specifications. Limited missile fragment impact tests will be conducted against conventional transparencies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, DEFINE THE LOADING ENVIRONMENT OF AEROSPACE VEHICLES FOR THE DEVELOPMENT OF DESIGN CRITERIA

E.W. TURNER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF131870)

One broad problem which the USAF must address is the design and fabrication of aerospace vehicles which have both high reliability and low life-cycle cost. Achieving these mutually conflicting goals requires a detailed knowledge of the loading environment to be used in developing valid design criteria, and advanced methods for computing the response of aerospace vehicles to this environment. The objective of this effort is to extend the present knowledge of the loading environment by acquiring and analyzing flight data, and developing techniques for computing the response of aerospace vehicles to the environment. This will lead to higher reliability and lower life-cycle costs of aerospace vehicles.

A large collection of gust data is available from the previous critical atmospheric turbulence (CAT) recording programs. The aircraft structural integrity program (ASIP) is the primary source of operational flight loads data. Complimentary data will be obtained from other recording programs conducted both by government agencies (including the AFFDL), and nongovernment agencies. The AFFDL recording programs will be conducted by installing special sensing and recording devices on both manned and unmanned flight vehicles, and flight simulators. Flight recorders will be developed when necessary to fulfill the future requirements of AFFDL recorder programs. Current data processing techniques will be used to reduce the data, and new techniques will be developed when existing techniques are inadequate. New methods will be investigated, and computer programs implemented to compute the response of aerospace vehicles to the gust and maneuver loading environment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, 200 CHANNEL FM/CW ILS

UNKNOWN, Amer. Electronics Lab. Inc., *Lansdale, Pennsylvania* 19446 (DN230916; N00019-73-C-0206)

The objective of this program is to provide a two-phase R/D effort to evaluate the cost and feasibility of modifying the existing AN/ARA-63 instrument landing system for compatibility with the national microwave landing system without costly aircraft changes.

The first phase will be a six-month's cost-benefit analysis plus study of feasible techniques. The second step will only be implemented if the cost impact to aircraft installation is minimal.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0024, AIRCRAFT ENGINEERING DESIGN AND CATALOG DEVELOPMENT

R. ST. JOHN, Ling Temco Vought Incorporated, *Dallas, Texas* (DF138230; F33615-76-C-3117)

The design branch is engaged in conceptual design studies of advanced weapon systems. In order to increase our in-house analysis capabilities, detailed data and weights prediction, methodology improvements are required in the aircraft systems area. However, due to the workload associated with the study efforts, personnel are not available to accomplish these tasks. The objective of this effort is to develop a data catalog of aircraft geometry and system characteristics and to develop an improved systems weights predicted capability. This effort will significantly improve

our capability to do systems trade-off studies relative to specific mission requirements.

Detailed geometry and mission-related system characteristics will be used in conjunction with statistical multiple regression analysis theory to obtain equations which describe the weight and geometric characteristics of the various aircraft systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, ADVANCED INLET/AIRFRAME INTEGRATION CONCEPTS

J.A. CAWTHON, General Dynamics Corporation, *Fort Worth, Texas* 76101 (DF133990; F33615-75-C-3044)

Advanced aerodynamic lift and thrust vectoring systems are being considered which may enable tactical aircraft to reach extreme angles of attack/yaw in the subsonic/transonic flight regime, thus making the requirements for inlet-engine compatibility more severe than in current systems. Design criteria is needed on integration of the inlet system with forward canards to reduce development and acquisition costs for future tactical aircraft. It is the objective of this program to define advanced inlet concepts for this environment which will prevent or attenuate flow distortion at extreme maneuvers, and employ concepts which are low-cost, lightweight and with improved reliability.

The approach will be to derive advanced geometry concepts, flow modulation devices and advanced airframe integration techniques. following a comparative design analysis, preliminary experimental validation will be conducted for proof of concept data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, LEADING EDGE DESIGN STUDY FOR SWEPT-BACK SLENDER WINGS WITH OR WITHOUT SEPARATION

R.K. NANGIA, Univ. of Bristol, *Bristol, England, United Kingdom* (DF140640; AF-AFOSR-3243-77)

In the design of high performance fighter aircraft having large wing sweep, compromises occur in meeting the constraints of efficient high-speed cruise and good transonic maneuverability. Careful design of the leading edge geometry can lead to significantly improved wing performance (lift-drag ratio) in both speed regimes. Applying droop in the leading edge region by means of flaps, variable camber devices, or slats can lead to improvements, although in general optimum geometric shapes must be found by trial and error. Leading edge design is further complicated for this class of wings by the possibility of flow separation and subsequent vortex formation. The object of the study is to provide guidelines to be used in designing leading edges of high-sweep wings in order to achieve the maximum aerodynamic efficiency.

A theoretical method will be developed to calculate the flow field for non-planar, highly swept wings of finite thickness having either separated or attached flow at the leading edge. The problem will be simplified by making the assumption of conical flow thereby allowing the problem to be reduced to a 2-d solution in the cross-flow plane in which conformal transformation techniques can be introduced. Leading edge separation will be analyzed with a Brown and Michael-type model for the free, rolled-up vortex sheet. This relatively simple approach will provide the means to investigate the details of the flow near the leading edge for a large number of cases at mimimum computational cost.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0027, ANALYSIS OF AIRCRAFT EFFECTS

UNKNOWN, Inst. for Defense Analysis, *Arlington, Virginia* 22202 (FA77WA-3965; FA160071 (TRAIS NO.))

Objectives are to: (1) summarize the status of research, in the U.S. and abroad, on the effects of high altitude aircraft operations on the stratosphere, with particular attention to effects on total-ozone column and climate; (2) undertake a review of the status of coupled chemistry-transport models of the effects of high altitude aircraft operations on climate; (3) summarize the state of knowledge with respect to the relationship between decreased ozone amount and changes in skin cancer incidence rates; (4) summarize data on the location, nature and amount of each natural atmospheric perturbation which has occurred over the last 20 years.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, LASER FLUORESCENCE MEASUREMENTS OF VIBRATIONAL ENERGY TRANSFER IN WATER AND AMMONIA

C.B. MOORE, Univ. of California, School of Chemistry, *Berkeley, California* 94720 (DF037470; F49620-76-C-0019)

AF function - weapons delivery, defense, reconnaissance and surveillance. Deficiency - rocket and jet engine exhaust plume technologies are in need of fundamental data on rates of reactions and nonreactive energy transfer, for prediction and analysis. Objective -this research is attempting to measure the rate constants for collisional transfer of vibrational energy (v-v and v-t, r) in polyatomic molecules occurring in exhaust plumes. How work contributes -the results obtained in this work will be particularly important in the area of IR signatures.

Collisional energy transfer between specific vibrational states, and collisional relaxation of vibrational energy to rotation and translation, are being experimentally studied by laser excitation of single selected energy levels and monitoring the resulting fluorescence. The data obtained in this way on carbon dioxide, water vapor as H2O(18), then H2O(16), and ammonia, individually and with various collision partners, will be used to derive the energy transfer rates and mechanisms.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0002, POLYMERIC MATERIALS WITH SPATIAL GRADIENTS IN STRUCTURE AND PROPERTIES

M.C. SHEN, Univ. of California, School of Engineering, *Berkeley, California* 94720 (DN223290; N00014-75-C-0955)

The use of polymeric materials by the Navy is pervasive, varying widely in form and function from rubber tires to hydraulic fluids. The properties of such materials are sensitive to the chemical nature and physical arrangement of constitutent long chain molecules. This research provides a means for introducing controlled structural variations to improve the performance of plastics and rubber materials in military applications such as noncrazing aircraft windows, noise, shock and vibration absorbers and plastic gasoline tanks.

Chemical and physical methods for generating ordered, spatial variations in the composition, structure and properties of polymers are investigated. These studies will cover alternative preparative and characterization techniques as well as mechanical and transport properties. Emphasis will be placed on determining relative merit and limits of promising approaches and the development of property-structure relationships in model systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0003, FREE RADICAL DETECTION AND THE STUDY OF GAS PHASE ADDITION POLYMERIZATION BY MEANS OF A DIFFUSION CLOUD CHAMBER

H.X. REISS, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (DF043240; F44620-76-C-0068)

AF function - this proposed research primarily falls in the 2.1 research objectives dealing with structural materials. Structural materials in use today are operating at or near their capacity as regards to stress, temperature and environment. This research deals with the equation of state (statistical mechanics), in particular the

change of phase taking place by the nucleation process. This is one of the most active and promising areas of research to extend the study of the limits of critical phenomena and phase transition. Deficiency - high-temperature stable, tractable bulk polymeric materials are needed for future application as resins for fabrication of second generation structural composites and use as structural adhesives. Needs are critical for high thermal and chemical stabilities, as well as for moderate temperature processabilities which do not give rise to evolution of deleterious, void-producing volatiles. As a side product, contributions to chemical consequences of high-power laser transmission through the atmosphere, and pollutant aspects of rocket and aircraft emissions will be studied. Objective - nucleation and condensation from supersaturated vapors is a very sensitive amplifying process, capable, under certain circumstances, of detecting individual atomic and molecular events. In the research suggested in this proposal, nucleation processes are to be studied which will amplify the non-equilibrium change in phase process. How work contributes - this research is a part of a new comprehensive program in statistical mechanics studies of real systems.

Some unique aspects of addition polymerization involving nucleation and cloud chamber studies are proposed. First a major problem which has occupied the minds of cloud chamber workers from the outset has been the effects of unwanted, trace, chemically induced nucleation. The investigators have found a method of scavenging chemically the polymerizable impurities. The task under this contract is to perfect and document this cleanup process. The second task is the validation of the mechanism of addition polymerization in several simple systems. The most reasonable working fluid appears to be water along with the vinyl monomers of ethylene, tetrafluoroethylene and styrene. When the mechanism of the above reactions are understood, investigations will be made to detect extremely small concentrations of free radicals. (Text Abridged).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0004, DOUBLE-LAYER STRUCTURE AND ELECTRODE KINETICS

R. DELEVIE, Georgetown University, School of Arts & Sciences, *Washington, District of Columbia* 20007 (DF043940; AF-AFOSR-3027-76)

AF function - electrical power for aircraft, satellite, and various subsystems is the source that keeps our communication systems and flight operations active. Deficiency - longer life, lighter weight, higher energy-density batteries are needed to meet the various operational requirements of the Air Force. Objective - investigations will be carried out on the double-layer structure at the electrolyte/electrode interface by a combination of recently developed techniques. These methods will be used to test and calibrate liquid metal electrodes and solid electrodes. How work contributes - information on specific adsorption and on double-layer potentials are crucial to the refinement of electrode kinetics, electrocatalysis, and problems related to the electrode/electrolyte interface.

Using the recently developed technique, the kinetic probe method, double-layer potential measurements will be made on electrolyte mixtures and solid electrodes. This method will be applied to the study of ionic strength mixtures of alkali fluorides, pseudohalides, nitrates and perchlorates, as well as aqueous buffer mixtures such as phosphate, citrate, and borate. The results will be directly useful for kinetic investigations. Kinetic probes will be used to study double-layer potentials at the solid electrode/water interface, i.e., platinum, nickel, zinc and various carbons. Attempts will be made to apply bubble pressure, ultra-fast admittance (Fourier transform), and kinetic probe techniques to double-layer effects on ion adsorption isotherms in dilute solutions, and to the simultaneous measurement of kinetic and thermodynamic data where electrochemical reactants, intermediates, or products are strongly adsorbed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0005, CHARACTERIZATION OF THE RESPONSE OF MATERIALS TO RAPID THERMAL AND MECHANICAL SHOCK LOADINGS

T.R. TUCKER, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN580004)

The objective of this program is to characterize the behavior of naval structural materials under rapid thermal and mechanical shock loadings. This requires a thorough knowledge of the variation in mechanical properties of these materials during and following transient or long-term thermal excursions; the mechanical shock response of materials to high-intensity radiation; and microstructural modifications induced by such environments which lead to the observed behavior. The knowledge and data generated in this program are relevant to several important Navy material problems, such as exposure to intense electromagnetic radiation, and the aerodynamic heating of launch and reentry vehicles.

Electron beam and laser radiation are used to generate rapid thermal and shock loadings of materials. Rapid heating rate, high-temperature testing facilities are employed to explore the behavior of materials at elevated temperatures. Thermal, mechanical and microstructural properties of structural alloys and composites are studied.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0006, INFLUENCE OF VARIOUS PARAMETERS ON INITIATION, STABILITY, AND LIMITS OF DETONATION

W. JOST, Univ. of Gottingen, *Gottingen, Federal Republic of Germany* (DF036540; AF-AFOSR-2541-73)

AF function - advanced chemical explosive weapons, weapon delivery and defense, close air support, aircraft component vulnerability and survivability. Deficiency - insufficient understanding of the basic mechanisms and dynamic processes of initiation, propagation, stability and limits of flames and detonations in reactive media and lack of realistic guidelines for predicting properties and blast damage potentials of unconfined homogeneous and heterogeneous explosions, for controlling combustion instability, propellant sensitivity and explosion. Objective - to formulate mathematical models realistically describing the mechanisms responsible for initiation, stability and propagation of flames and detonations in reactive media. How work contributes - will provide additional understanding of, and analytical models realistically describing initiation stability and propagation of flames and detonations in reactive media not now available, and will contribute to establishing realistic guidelines for developing unique high-power conventional (chemical FAE) explosive devices, effective flame and detonation arrestors, reliable propellants and stable air-breathing and hybrid combustors.

Theoretical and experimental studies of the influence of various parameters on initiation, stability, and limits of detonation in hydrocarbon-air and other reactive mixtures will be carried out. Mechanisms important in flame and detonation development in both confined and unconfined systems under cylindrical and spherical symmetry conditions will be investigated experimentally and compared with the 1-dimensional case. Experiments will be carried out to determine whether unconfined reacting fuel-air mixtures can cause acceleration of flames and transition to detonation. Attempts will be made to separate wall effects and homogeneously generated turbulence in the unconfined reacting mixture. Also, the influence of turbulence in the unburned reactive media on acceleration of spherical flames and transition to detonation will be determined. A complementary theoretical analysis will interpret the experimental data, with emphasis on elucidating the basic mechanisms governing the detonation phenomena.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0007, ANALYTICAL GAS PHASE SPECTROMETRY AND COMBUSTION DIAGNOSTICS

J.D. WINEFORDNER, State University of Fla. Sys., School of Arts & Sciences, *Gainesville, Florida* 32601 (DF041790; F44620-76-C-0005)

AF function - to satisfy geometric constraints in future propulsion systems and to increase afterburner and combustor performance. Deficiency - research is needed in instrumentation and diagnostics to attain more accurate experimental values of critical parameters associated with combustor design criteria. Objective - to develop diagnostic methods for measuring temperatures, concentrations, and velocities of atomic and molecular species in laminar and turbulent gas phase flames. How work contributes - the research results will be utilized to provide spatial and temporal profiles of flame temperatures, gas species, and gas velocities. From such measurements, experimental models of combustion processes in the luminous portion, and of species, masses, and temperatures in the non-luminous zone can be determined and correlated.

More sensitive, selective, precise, reliable, and rapid spectrometric methods of measuring trace concentrations of atoms and molecules in jet engine exhausts, lubricating oils, metallurgical and biological samples will be developed. Diagnostic techniques to be studied include - optical methods, such as UV-visible emission and absorption spectroscopy of atoms and molecules, UV-visible-IR fluorescence spectroscopy, and Raman spectroscopy, and mass probe methods. The two-line fluorescence technique for measuring temperatures in practical combustion devices will be exploited.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0008, THE BEHAVIOR OF ALUMINUM IN COMBUSTION OF SOLID ROCKET PROPELLANTS

E.W. PRICE, Georgia Inst. of Technology, School of Aerospace Engin., *Atlanta, Georgia* 30332 (DF042200; AF-AFOSR-2912-76)

AF function - most solid propellants employed in Air Force rocket weapons rely upon aluminum particles in the mixture to improve performance and combustion stability. Deficiency - little is known about certain areas of the combustion of aluminum (the effect of the oxide skin, the accumulation of aluminum on the burning surfaces, etc.). Objective - to fill in gaps in the knowledge of aluminum combustion. How work contributes - will permit the design of more effective rocket weapons.

This effort will study several aspects of aluminum combustion including preignition behavior where samples are subjected to externally induced heating in controlled atmospheres, the behavior of aluminum in ammonium perchlorate systems using packed formations, localized introduction of a diffusion flame through geometrically controlled introduction of a binder, extension of the localized diffusion flame approach using a cylindrical tube of binder, and the effect of gas flow on the aluminum combustion.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0009, PARAMETERS AFFECTING THE PREPARATION OF 3-FLUOROSALICYLALDEHYDE VIA THE REIMER-TIEMANN REACTION

P.A. PINKE, Univ. Oil Products Company, *Des Plaines, Illinois* 60016 (DF049110; F49620-77-C-0104)

AF function - critical subsystems and components and their interactions are vital to the successful accomplishment of the AF flight vehicle mission. Deficiency - improved methods are needed for converting starting materials and intermediates into compounds such as fluomine which are needed in oxygen generating systems. Objective - the objective of this research is to study the parameters affecting the Reimer-Tiemann reaction whereby 3-fluorosalicylaldehyde is made, thus increasing the yield of compound for use in making fluomine. How work contributes - the work should provide information leading to a more readily available and less expensive source of fluomine for use in oxygen generating systems in military aircraft.

In order to increase the selectivity of the Reiman-Tiemann reaction in the synthesis of 3-fluorosalicylaldehyde the non-aqueous modification of the reaction will be systematically studied in order to maximize the levels of O-fluorophenol conversion and 3-fluorosalicylaldehyde selectivity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0010, DEVELOPMENT OF HOLOGRAPHIC RECORDING MATERIALS

A.A. FRIESEM, Weizmann Institute of Science, *Rehovot, Israel* (DF138660; AF-AFOSR-3004-76)

Photoplastics and photodielectric polymers exhibit a high potential as efficient, low-cost recording materials for holography. Development work is required, however, before these materials can be utilized. In this effort, recording materials needed to facilitate making real-time holograms will be developed. This will provide improved techniques for performing nondestructive inspection of aircraft to determine structural integrity.

Photoplastics and photodielectric polymers will be used and evaluated in holographic tests representing typical real-time recording arrangements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

3.0011, HYDROGEN EMBRITTLEMENT IN TITANIUM

H.A. ALPERIN, U.S. Navy, Res. & Technology Department, *Silver Spring, Maryland* 20910 (DN585158)

To determine parameters relevant to hydrogen embrittlement of Ti using neutron diffraction and scattering methods.

Neutron diffraction will be used to determine the site occupancy and vibrational parameters of the hydrogen atoms in the alpha and beta phases which play an important role in the embrittlement process. Quasielastic incoherent scattering by the hydrogen will enable the true internal hydrogen diffusion rate to be determined. Neutron gaging methods will be developed to detect the diffusion of hydrogen in titanium and titanium alloy samples under stress and as a function of temperature. Special neutron scattering methods will be developed to measure 3-dimensional residual stresses of the stressed samples; X-ray methods can only detect 2-dimensional surface residual stresses. Phonon measurements on single crystals will be used to study the lattice decohesion caused by hydrogen in titanium.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0012, CALCULATION OF CERAMIC PHASE DIAGRAMS

L. KAUFMAN, Manlabs Incorporated, *Cambridge, Massachusetts* 02138 (DF042880; F44620-76-C-0060)

AF function - ceramic materials are being developed for a variety of components (e.g., blades, vanes, rotors, combustors, bearings and seals) in future gas turbine engines and for a variety of electronic and optical components in aircraft. Opportunity - the process of selecting the chemical composition and heat treatment of any material to obtain optimum properties has been a slow one based upon past experience and time-consuming experimentation. Over the past ten years computer techniques have been developed for calculating the phase diagrams of simple binary and selected ternary metal alloy systems. This offers the possibility of rapidly and economically searching out phase equilibria on any combination of metals desired. Objective - the calculational techniques developed for metal alloys will be extended into ceramic systems based on combinations of Cr, Al, Fe, Mg, and oxygen. How work contributes - this work contributes to the selection of thermodynamically stable materials for future af turbine engines.

The lattice stability, compound and solution phase interaction parameters will be evaluated to characterize the stable and metastable phases. Thermochemical data will be estimated from existing experimental phase diagrams where necessary.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0013, FRACTURE AND FATIGUE OF BI-MATERIALS

J.W. MAR, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DF037950; F44620-74-C-0023)

AF function - Air Force advanced aerospace vehicles require improved structural efficiency and durability. Opportunity - in order for the Air Force to exploit the application of composite materials for primary structures knowledge of their fracture and fatigue behavior is necessary. Objective - the objective of this research is (1) to develop an understanding of the compression-compression fatigue behavior of graphite-epoxy laminates and (2) investigate fracture behavior, notch sensitivity and applicability of linear fracture mechanics to boron/aluminum. How work contributes - research will contribute to basic understanding of composite structural materials for aerospace vehicle application.

Experiments will be conducted which investigate the compression-compression fatigue of graphite epoxy. Material selected is used on B-1. Four-point bend, honeycomb-stiffened specimens will be used for this study. Both unnotched and prenotched specimens will be used in this research. Experiments will also be conducted using boron/aluminum specimens. This research will study the fracture behavior of laminated specimens with stress raisers. Hybrid finite-element solutions using materials orthotropic behavior will be compared with experimental data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0014, PHYSICS OF FRACTURE IN ORIENTED POLYMERS 13630-MS

D.K. ROYLANCE, Mass. Inst. of Technology, Graduate School, *Cambridge, Massachusetts* 02139 (DA0E9128; DAAG29 76 C 0044)

To study frature phenomena in oriented semi-crystalline polymers and develop an analytical rate-process model of fracture which depicts realistically the distribution of spatial defect sites as well as the distribution of tie-chain lengths. The research is relevant to Army high-performance applications of structural polymers in materiel such as armor, canopies, and fuze components.

Gel permeation chromatography (GPC) will be used to determine the distribution of intercrystalline tie-chain scission that occurs in oriented polymers subjected to stresses up to and including fracture, and at various temperatures and loading rates. The GPC observations will be correlated with a thorough characterization of the material structure (especially amorphous fraction and orientation) and with auxiliary measures of molecular fracture (EPR, IR spectroscopy, and small-angle X-ray diffraction).

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0015, HARDENING OF TRANSPARENT MATERIALS AGAINST LASER RADIATION

R.E. SACHER, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4751)

Current transparent materials utilized in windshields, protective masks, goggles, etc., exhibit inadequacies when interacted with laser weapons. The objective of this effort will be to take the optimum system chosen in project number 1T162105AH84 and fabricate windshields. These windshields will be evaluated for their optical, thermal, environmental, ballistic and mechanical damage tolerance as well as protection against high-energy laser before and after usage. Major thrust - aircraft survivability.

The optimum laser-hardened system chosen from project number 1T162105AH84 will be fabricated into helicopter windshields. These windshields will be evaluated for their optical quality, before and after thermal cycling, environmental aging and service use and ballistic and mechanical properties again before and after exposure and field testing. High-energy laser evaluation will be performed on the windshields prior to and after the completion of flight testing.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0016, WEAPONRY - PROCESSES AFFECTING COMBUSTION OF SOLID PROPELLANTS

M. SUMMERFIELD, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DN623049; N00014-75-C-0705)

The Navy missile arsenal contains a wide variety of solid-propellant rockets, and it is the objective of this task to advance the understanding of performance behavior of solid-propellants, and thereby lay the scientific groundwork for solid-propellant rocket developments of the future. The main emphasis here is on solid propellant combustion embracing the description and incorporation into theoretical scheme all processes, physical and chemical, which occur during the burning of a solid propellant. The fundamental studies of this task form the basis for selection of propellant ingredients and physical design of the solid-propellant grain which may be used in Navy ordnance rockets, as well as in solid-propellant rockets for any application.

The pressure dependence of the burning rate of RDX and RDX composite propellants will be studied emphasizing the kinetics of RDX decomposition and the rates of reaction of the decomposition products. Differential scanning colorimetry will be used to probe the nature of the RDX melt layer. Low-pressure pyrolysis studies of RDX will be made to better specify the rate and product distribution of RDX decomposition. These rate data will be used in models of the burning process that include reaction, momentum, energy, and mass transfer rates.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0017, INFLUENCE OF ANNEALING ON THE STRENGTHS OF SECONDARY RELAXATIONS IN GLASSES

M. GOLDSTEIN, Yeshiva University, School of Science, *New York, New York* 10033 (DF037090; AF-AFOSR-2540-73)

AF function - advanced aircraft systems will require new lightweight structural components with improved environmental stability and reliability. Deficiency - the process control of new thermally stable polymeric systems for matrix resins and adhesives is not well understood. Objective - the quantitative relationships between glass structure, relaxation processes, and annealing treatments in the transition range of noncrystalline solids will be determined. How work contributes - it is expected that this research will lead to a better understanding of the glass transition phenomena and generate information for the control of the glass transition temperature and, thereby, polymer processing and the resultant engineering properties.

The dependence of relaxation strength on structural state or fictive temperature in glasses including molecular and hydrogen bonded liquids, fused salts and organic high polymers will be investigated. The beta-relaxation and low-temperature relaxations will be studied by dielectric and calorimetric measurements. The thermodynamic implications of various structural hypotheses will be explored to determine which glass structural theory is supported by the experimental data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0018, ELECTROMAGNETIC SHIELDING OF COMPOSITE MATERIALS

R.F. STRATTON, U.S. Air Force, Rome Air Development Ctr., *Rome, New York* 13440 (DF736830)

The objectives of this effort are to: 1. Develop the techniques to quantitatively determine the electrical characteristics (conductivity, permittivity and permeability) of composite materials. 2. Define the concept of shielding effectiveness such that it is a function only of the material's intrinsic parameters and can thus be used as input data to solve systems problems, devise standard techniques for the measurement of shielding effectiveness, and develop analytical methods for predicting shielding effectiveness as a function of the material and its shape.

Personnel from the RADC post-doctoral program will survey the literature and contact personnel from government, industry and education institutions to determine the measurement techniques used to collect the data and the general composition of the materials being developed. Based on the results of this survey a plan will be formulated to develop the additional capability needed to perform the activities stated in the objective.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

3.0019, CHARGE TRANSPORT IN POLYMERS 14424-P
M. SILVER, Univ. of North Carolina, School of Arts & Sciences, *Chapel Hill, North Carolina* 27514 (DA0F8924; DAAG29 77 G0081)

To study experimentally and theoretically charge transport in polymer films possessing very small carrier mobility. Relevance. The army is entering into a time when major commitments will be made to the utilization of these 'active' polymer films (active in both the piezoelectric and pyroelectric sense), but the mechanism for these properties is still in deep dispute. This work is a necessary first step to clarify question of the mechanism so that long-term stability may be forecast. The PVF sub 2 polymer film is being explored as a component in a present fuzing program.

Polymer films having small carrier mobilities will be investigated using time-of-flight techniques with field interruption and field reversal to control the time carriers spent in the material, and charge recombination will be studied as a function of light intensity and applied field to gain further insight into the time dependence of the charge transport behavior.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0020, PULSED LASER INTERACTIONS WITH TITANIUM ALLOYS 12794-MS
A.H. CLAUER, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DA0H5576; DAAG29 75 G0115)

To investigate pulsed laser-material interactions including the generation of shock waves and mechanisms of energy absorption and material damages that relate to microstructural changes originating from plastic deformation and phase transitions. Relevance - the Army Laser-hardened Materials and Structures Plan (1974) includes pulsed laser effects as a subject which requires research effort. The Army evaluators cite the areas of countersurveillance, armor, and metal processing as pertinent to the proposed research.

(a) Determine means to develop the highest and longest shock pressures possible with the existing facilities (and with the aid of available computer codes), (b) carry out laser pulsing experiments based upon a range of pulse configurations and durations, overlay materials, energy deposition rates, making appropriate measurements of peak pressures, and of related alteration (phase changes, defects, etc.) to the structure and degradation or improvement of properties of a series of titanium alloys.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0021, ANALYSIS OF AIRCRAFT FUELS
N. HODGSON, Monsanto Research Corporation, *Dayton, Ohio* 45407 (DF460030; F33615-76-C-2014)

This program is designed to provide a capability for solving non-routine problems in aircraft fuels technology. It encompasses the establishment of the causes of operational problems, the definition of fuel properties that are critical for optimizing combustion behavior and engine performance, and the development of techniques for determining specific fuel additives and trace contaminants.

Well-established laboratory techniques are exploited in solving fuel-related problems encountered during this program. These techniques include primarily chromatographic and spectroscopic methods, the program also involves efforts to improve the speed, accuracy, sensitivity, and cost of all applicable laboratory procedures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0022, DEVELOPMENT AND APPLICATION OF AIRCRAFT FUELS
R.D. BUTLER, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF454850)

Develop analysis and test methods necessary for the characterization, specification of properties, and quality assurance of aviation turbine fuels and fuel additives. Evaluate the effects of fuel system materials on fuel properties and fuel quality. Provide fuel chemistry expertise in support of related research and development programs and in support of field problem beyond the existing state-of-the-art.

A. Fuel blending -- Shelldyne H and other fuels will be blended to achieve high heating values yet reduce viscosity to acceptable values. Shelldyne isomers will be isolated and reblended to achieve the same goal as with blending. B. Analysis -- specialized gas chromatographic, infrared, etc., methods will be developed to identify fuel composition and in particular to identify trace materials in fuel known to have been degraded relative to some property such as thermal stability. C. Containment -- advanced fuels will be exposed to proposed contaminant materials and subjected to specification tests. D. Cleanliness -- new additives will be evaluated in small- and large-scale filter/separator equipment to determine if solids and water removal capability is affected. Equipment and instrumentation for monitoring fuel cleanliness will be evaluated as it is made available. Oxygen will be regarded as a contaminant if deoxygenation becomes a requirement to provide adequate thermal stability in new aircraft systems. Provision is included here to support any development of deoxygenation systems as needed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0023, ALTERNATE FUELS COMBUSTION INVESTIGATIONS
T.A. JACKSON, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF458210)

Expanded-specification petroleum fuels and fuels from oil shale and coal are being considered for future use in air force aircraft. The objective of this effort is to examine and quantify the effects of appropriate fuel character changes on the engine combustion systems. these findings will be used as a basis for decisions regarding-(a) the extent to which current systems can tolerate changes in fuel quality, (b) future modifications to combustion systems to allow use of reduced quality fuels, and (c) the trade-off of fuel processing cost versus the cost of modified combustor designs.

The program described below is part of an integrated plan with nasa lewis research center to study the alternate fuels problem. Recognizing that design and thermodynamic conditions can influence the fuel effects, both older (t56) and modern (f101) systems will be studied for main burner characteristics. These investigations shall make use of the room 20 combustion facility (see work unit 30480542). Data acquisition will be performed on a t56 single combustor prior to testing on the more complicated f101 sector system. A j85-5 engine will be used to investigate the influence of fuel quality on afterburner combustion performance (see work unit 30660532). The order in which combustion parameters will be studied is- combustor liner temperature, combustion efficiency, smoke emission, gaseous exhaust emissions, fuel bound n effects, blowout, ignition, stability to airflow transients, pattern factor, and deposition. The requirement to perform additional efforts oriented toward analytical modeling of important processes is evident.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0024, TURBINE ENGINE LUBRICANT RESEARCH
H.A. SMITH, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF451270)

Establish basic parameters of turbine engine lubricant degradation from which new and improved methods and guidelines for assessing and defining the performance capability of current and advanced high-temperature lubricant can be made. Correlate the physical and chemical characteristics of wear particles with the mechanisms of wear occurring in turbine engine lubrication systems. Investigate and develop monitoring techniques for lubricant systems. Investigate foaming characteristics of turbine lubricants and the effects of find filtration on lubricant foaming as well as other lubricant properties.

Develop and utilize analytical methods of analyses for correlating lab evaluations and full-scale engine experience. Study wear mechanisms through ferrography and other lube wear metal analysis techniques satisfactory for field use.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0025, STRUCTURAL STUDIES OF MONOMERIC MODEL COMPOUNDS AND RELATED ORDERED POLYMER SYSTEMS

A.V. FRATINI, Univ. of Dayton, School of Arts & Sciences, *Dayton, Ohio* 45469 (DF047740; AF-AFOSR-3267-77)

AF function - advanced aircraft will utilize large-area, lightweight structural composites which will require sustained performance in severe environments. Deficiency - the processing, property and microstructure interrelations for the design of composite matrix materials which will provide sustained performance have not been established. Objective - explore the relationship between structure and physical and chemical properties in paraconfigured polybenzoxazoles (PBO) polymers by the determination of X-ray structures of monomeric compounds capable of functioning as model compounds. How work contributes - this research will support the AFML/AFOSR study of ordered, aromatic-heterocyclic polymer systems in search of new nonmetallic materials that can function as self-reinforced composites.

(1) Single-crystal X-ray diffraction studies of model compounds with emphasis on detailed structural parameters of the bisoxazole moiety in a variety of environments, the effect of bulky substituents on the conformation of the polymer backbone, and knowledge of the gross packing features of the polymer chains, and (2) dynamic X-ray diffraction imaging studies centered on correlation of microstructure to physical properties, and observation of changes in morphology with simultaneous mechanical deformation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0026, HYGROTHERMAL COUPLING EFFECTS ON COMPOSITE MATERIALS

G.C. SIH, Lehigh University, Inst. of Fracture & Solid Mech, *Bethlehem, Pennsylvania* 18015 (DF047520; F49620-77-C-0054)

AF function - advanced aerospace vehicles will require improved performance and durability in the future. Deficiency - there is a lack of knowledge related to the behavior of advanced composites when exposed to high humidity and elevated temperature. Objective - objective of this research program is to develop a mathematical model of the response of composites to hygrothermal coupling. How work contributes - this research contributes to the Air Force R&D effort to utilize advanced composites on aerospace vehicles.

Analysis techniques will be developed to consider the combined effects of moisture absorption and elevated temperature on composites. The analysis of these two effects will consider coupled behavior. Plate structures will be used in the analysis and utilize symmetric and unsymmetric surface exposure. In addition, sudden surface temperature changes will be considered and their influence on the spatial distribution of stress, strain, heat and concentration studied.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0027, MORPHOLOGY AND MECHANICAL BEHAVIOR OF ISOMERIC GRAFT POLYMERS AND INTERPENETRATING POLYMER NETWORKS

L.H. SPERLING, Lehigh University, School of Engin. & Phys. Sci., *Bethlehem, Pennsylvania* 18015 (DF042460; AF-AFOSR-2945-76)

AF function - future Air Force flight operations require better environment resistant and structure materials. Deficiency - a need exists for polymeric systems with better high-temperature stability than presently existing materials. Objective - the research will focus on the synthesis of selected interpenetrating polymer networks (IPN's) and develop correlations among synthetic detail, morphology and physical and mechanical behavior of these systems. How work contributes - the research will provide basic information pertinent to the development of improved environment resistant and structural materials.

Experiments will be continued on deliberate polymer modification with the grafting of epoxy and poly-n-butyl acrylate simultaneous interpenetrating polymer networks, using controlled amounts of glycidyl methacrylate as the grafting monomer. Special studies on the effect of crosslinking in relation to the time of polymerization in INP's will be undertaken, as well as degrafting and regrafting experiments. Electron microscopy will be used in conjunction with dynamic mechanical spectroscopy. Emphasis will be placed on the inter-relationships among the synthetic detail, morphology, and glass transition behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0028, DIRECTIONAL SOLIDIFICATION OF NONOXIDE EUTECTICS 14069-MS

V.S. STUBICAN, Penn. State University, School of Engineering, *University Park, Pennsylvania* 16802 (DA0E9298; DAAG29 77 G0057)

Study the directional solidification of several refractory carbide and boride compositional systems which exhibit eutectics, and relate the resulting microstructures to selected mechanical properties of the materials. Relevance - the materials to be studied may find use as high-temperature unlubricated bearings for helicopters, as ceramic tool bits, as high-temperature ceramic turbines and adiabatic diesel engines for Army vehicles, and as high-temperature missile components.

Determine the crystallography of the eutectic systems and elucidation of the fundamental factors which determine the topotaxial relations, measure the three- and four-point bend strength of the specimens as a function of temperature up to 2000 degrees C, and evaluate the microhardness and wear resistance of the specimens.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0029, ANISOTHERMAL OXIDATION OF TITANIUM AND ITS ALLOYS

A.B. PRUITT, Clemson University, School of Engineering, *Clemson, South Carolina* 29631 (DF042320; AF-AFOSR-2919-76)

AF function - aircraft turbine engines and airframes employ titanium and its alloys extensively because of their light weight and high strength properties. Opportunity - high heating rates, such as encountered in engine stalls and rubs and in high-energy laser exposure, can lead to rapid oxidation and deterioration of the metal structures. Objective - this study will seek to understand the behavior of titanium alloys under combined influences of steady state and superimposed transient heating rates. How work contributes - understanding the kinetics and the critical metallurgical parameters influencing the rapid oxidation process will allow the rational design and selection of new alloy components for future engines and airframes.

Through an iterative process of experiment and mathematical modeling recommendations will be generated involving material selection, material processing, critical thermal regimes, and critical energy impulse data. Special emphasis will be placed upon generation of basic information for application to engine fires and laser-assisted ignition.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0030, DEVELOPMENT AND PRACTICAL APPLICATION OF THE THEORY OF MATERIALS

J.R. VANWAZER, Vanderbilt University, School of Arts & Sciences, *Nashville, Tennessee* 37232 (DF046680; AF-AFOSR-3145-77)

AF function - Air Force flight operations have continuing needs for improved structural and environment resistant materials. Deficiency - a need exists for methods to predict the best ap-

proaches for making new materials. Objective- the research deals with the development and practical application of the theory of materials to problems of importance to the Air Force. How work contributes - the work will provide a basis for the synthesis of desirable new materials without having to depend entirely on trial-and-error experimental procedures.

The research is concerned with the development and investigation of improved methods for theoretical calculations of practical value, dealing with the structure and properties of predominantly nonmetallic materials. Emphasis will be on practical extensions of recent findings concerning the use of pseudopotential theory in molecular calculations (the Nocor method). The proposed studies include (a) comparing various alternative ways of establishing the core-potential functions in order to find the best method, (b) inclusion of several configurations in the calculations on a given state of a molecule and (c) extension to open-shell molecules. Extension of the Nocor method to organic and inorganic polymer structures by employing periodic boundary conditions will be explored.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0031, NONDESTRUCTIVE EVALUATION OF METAL FATIGUE

J.R. BARTON, Southwest Research Institute, *San Antonio, Texas* 78228 (DF018570; F44620-75-C-0042)

AF function - Air Force structures and components require improved techniques for nondestructive inspection and evaluation which enhance both the sensitivity and reliability of these techniques. Deficiency -airframe and engine structures are currently nondestructively evaluated by techniques which have sensitivities and reliabilities that are deficient to meet Air Force reduced cost of ownership goals. Objective - the objective of this research is to develop quantitative techniques for the evaluation of fatigue cracks in metallic structures. How work contributes - results of this research contribute to Air Force goals of insuring the damage tolerance of new structures and increasing the effectiveness of maintenance inspection.

Five inspection techniques will be studied under this research program - magnetic perturbation, ultrasonics, Barkhausen noise, electric current injection, and an AC four-contact electric probe. These techniques will be used to examine fatigue cracks in AISi4340, HY180 and Ti-6-4. Measurements of fatigue cracks will be made to develop quantitative relations between crack characteristics and measured signals. Influence of plastic zone size on magnetic perturbation signals and models to study magnetic flux leakage at fatigue cracks will be investigated. Thus the approach involves both theory and experiments combining physics, mechanics and knowledge of instrumentation to advance this technology.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, FLOW FIELD COMPUTATIONAL METHODS FOR MISSILE LAUNCH & TRANSONIC FLIGHT

B.Z. JENKINS, U.S. Army, Aeroballistics Directorate, *Huntsville, Alabama* 35809 (DA0F1294)

To be able to predict the aerodynamic behavior of missiles while in the influence of disturbing effects due to launch environment during the low-speed acceleration phase of flight and during the transonic speed range.

Computer programs will be acquired and adapted to meet AMICOM requirements. This will be supplemented by in-house programs to incorporate other lines of analytical research and to carry out corroborating experiments.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Aeroballistics Directorate

4.0002, VARIABLE GEOMETRY TORQUE CONVERTER

KOEPSEL, Signal Companies Incorporated, *Phoenix, Arizona* 85034 (DF455640; F33615-76-C-2013)

To design and evaluate a variable reactor system for the B-1 torque converter. Provides a means of varying the HP absorbed by the torque converter so that it can utilize all available APU output power under any conditions.

A mechanically variable stator (breadboard) shall be designed, fabricated and demonstrated in the existing B-1 developmental torque converter.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0003, FLUIDIC FUEL CONTROL FOR TURBINES

D. SCHAFFER, Signal Companies Incorporated, *Phoenix, Arizona* 85034 (DA0F5761; DAAG39-76-C-0129)

To fabricate, test, and deliver a fluidic fuel control and air bleed load control system for the Airesearch GTCP85-180 gas turbine engine.

A fluidic speed and temperature circuit interfaced with an electronic circuit controls the engine fuel valve. Three control systems are to be delivered and one system will be engine tested for 50 hours.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Harry Diamond Lab.

4.0004, FAILURE MECHANISMS IN NICKEL HYDROGEN CELL

H. ROGERS, Hughes Aircraft Company, *El Segundo, California* 90245 (DF457670; F33615-75-C-2025)

To increase the performance, life and reliability of nickel-hydrogen energy storage cells by identifying and countering critical causes of degradation and failure.

This program provides for exploratory development on techniques for countering known and suspected failure mechanisms in nickel-hydrogen cells. It emphasizes problems related to electrolyte management, thermal management and oxygen management. Work will be conducted primarily on cells and cell-related structures, components and materials. For those failure mechanisms for which effective solutions are found and demonstrated in component-level laboratory tests, final verification of the effectiveness of the solution will be made in full-size lightweight cells. General solutions which will be effective in all orbits are desired, but verification of the solutions will be done under the simulated orbital conditions which are most rigorous for the solution--usually low orbit.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0005, MULTIPLE-BEAM ARRAY

R. TANG, Hughes Aircraft Company, *Fullerton, California* 92634 (DF900680; F19628-75-C-0196)

AF function - satellite-to-aircraft communication. Deficiency -improved antenna performance, particularly in achieving multiple beam coverage within limited spatial regions with a high-gain array. Research - investigation of new antenna techniques using array apertures and multiple-beam feed networks. How research contributes - present multiple-beam array techniques utilize closely spaced elements and associate one multiple-beam port with each element. Limited sector coverage allows use of fewer elements and so can reduce array cost and weight.

The approach is to devise and investigate lightweight antenna techniques that are applicable to the problem of forming multiple independent beams within a limited spatial sector. Particular emphasis will be in seeking out innovative concepts that will advance the state-of-the-art in array techniques for multiple beam sector coverage.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0006, NEW METHODS FOR ANALYSIS OF THE PERFORMANCE OF GUIDANCE AND CONTROL SYSTEMS

R.S. BUCY, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (DF045840; AF-AFOSR-3100-76)

AF function - estimation is a singularly important aspect of the design of high-accuracy guidance, navigation and control systems for sophisticated AF systems. Deficiencies - the estimation or noise filtering problem in many cases is inherently nonlinear, and therefore not amenable to known linear filtering techniques. Objective - the objective of this research is to develop methods for routinely handling nonlinear filtering problems. How work contributes - better techniques for nonlinear filtering will find immediate application in improved performance and accuracy for complex systems.

Three approaches will be investigated. At great computational expense optimal nonlinear estimation has been achieved. Now parallel and pipeline digital computers will be applied to the problem, with hopes of doubling the dimensionality of problems which can be handled. The second approach is to derive easily evaluated upper and lower bounds for suboptimal filter error variance, allowing one to evaluate candidate filters before building them. Finally, an investigation of the Riccati equation, which is fundamental in questions regarding both linear and nonlinear filtering, will be conducted. It is hoped to extend the refined global existence theorems to the case of complex solutions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, TURBULENT FLAME STABILITY AND SPREADING WITH GAS JETS AND SPRAY CONTROL

P.R. CHOUDHURY, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (DF035480; AF-AFOSR-3354-77)

AF function - advanced air-breathing engines, airborne weapon delivery and defense, reconnaissance, and transport. Deficiency -insufficient understanding of the basic mechanisms and processes involved in advanced air-breathing combustors and lack of realistic guidelines for predicting propulsion system performance and designing combustors with improved reliability and efficiency and acceptable pollutant emissions. Objectives - to understand and develop accurate theoretical and mathematical models describing the mechanisms and processes of gas jet-flame interactions involving vortices induced by flow separation and gas jets associated with turbulent reacting flow fields encountered in advanced air-breathing combustors, e.g., dump burners. How work contributes - will provide additional understanding and realistic analytical modeling of turbulent reactive flow not now available, will contribute to evaluation of practicability of utilization of aerodynamically created vortex-induced combustion and stabilization and guide design and development of advanced combustors using this concept with improved reliability, combustion efficiency and acceptable exhaust gas emissions.

Study will be made of mechanisms and processes of gas jet-flame interactions including investigation of gas jets used as fluid amplifiers to promote and stabilize vortex combustion, reduce combustion instability and combustion-driven noise. Experiments will be conducted in several quasi 2- and 3-d burners of different characteristic diameters. Cross jets will be introduced at the combustor periphery upstream of the flameholder to create vortices in the main fuel-air stream. The degree of amplification of the recirculation zone in a cylindrical burner with cross jets will be determined to ascertain optimum location and total flow rate of jets. Burner characteristics with air jets performing the dual role of fluid amplifier and swirl generator will be critically examined. Particular emphasis will be placed on the causes of rough burning, spectral character of the pressure fluctuations and fuel stratification in a volume-limited cylindrical burner. The behavior of fuel droplets in the highly amplified, swirling, recirculation zone will be studied in an effort to control fuel stratification by providing an optimum residence time for a given fuel spray. (Test Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0008, FUNDAMENTAL PRINCIPLES OF FLOW-FLAME INTERACTIONS AND TRANSIENT FLAME PHENOMENA

M. GERSTEIN, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (DF029660; AF-AFOSR-2876-76)

AF function - advanced air-breathing combustion engines and chemical explosive weapons, weapon delivery and defense, close air support, transport. Deficiency - insufficient fundamental understanding of the basic fluid dynamic, surface and chemical processes associated with turbulent reacting vortex (swirl) flows in advanced high-speed air-breathing combustors under steady-state and transient conditions and of the basic mechanisms of homogeneous ignition and propagation of unconfined fuel-air explosions. Objective - to formulate realistic analytical representations of the flow-flame interactions and steady and transient ignition and flame phenomena associated with vortex stabilized combustion in advanced air-breathing combustors and with homogeneous ignition, flame and detonation propagation in distributed fuel-air clouds. How work contributes - will provide additional understanding and realistic analytical modeling of the transient and steady-state behavior of turbulent reactive flow fields and of spontaneous reactive additives on programmed homogeneous ignition in vortex combustion and fuel-air clouds, and will contribute to establishing guidelines for developing efficient, stable advanced air-breathing combustors and determining the feasibility of possible new single-event fuel-air explosive devices.

This investigation deals with flow-flame interactions of a fuel spray under realistic combustor conditions simulating the behavior of mixed fuels, fuel impingement on hot surfaces, and the use of spontaneous reactive additives designed to provide programmed ignition in vortex combustion and fuel-air clouds. Included is study of the following - transient behavior of a fuel spray igniting and burning in the turbulent vortex flows associated with high-speed air-breathing and hybrid combustors, transient vaporization of mixed fuels associated with homogeneous ignition of fuel-air explosions, liquid-surface interactions including surface vaporization, liquid decomposition and polymer formation and liquid-gas feedback as it affects vortex combustion efficiency and stability. A combustion tunnel and associated laser Schlieren, high-speed photography, Doppler techniques and gas chromatography will be used to carry out experiments and obtain quantitative data. Multidimensional time-dependent analysis will be applied to the liquid-surface and liquid-gas studies. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0009, BOUNDARY LAYER TRANSITION

R.E. KAPLAN, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (DF042750; AF-AFOSR-3094-76)

AF function - aerospace vehicles. Deficiency - lack of prediction methods for forces, moments, heat transfer rates, etc., acting on aerodynamic shapes when flow changes from laminar to turbulent. Objective - develop prediction methods which are adequate for predicting the phenomena over a flight vehicle over its entire flight regime. How work contributes - this study will investigate both theoretically and experimentally the area of transitioning boundary layers. Validation of a proposed theory will be examined. Techniques of measurement and calculations will also be developed to learn more about the dynamic modeling of turbulent production.

The former wind tunnel of the National Bureau of Standards is being set up for use by the grantee. Thorough check-out and calibration of this tunnel, plus installation of a traversing mechanism, will be followed by construction of a fifteen-foot-long flat plate model for boundary layer study. During the current year this equipment will be used to study the coupling between a well-controlled periodic oscillation, introduced just outside the boundary layer, with the Tollmien-Schlighting waves in the boundary layer. The current year's theoretical work will consist of the attempt to establish a sound physical basis for a boundary layer transition criterion proposed by the principal investigator on intuitive grounds.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, OPTICALLY PUMPED MERCURY LASERS FOR RING LASER GYROSCOPE APPLICATIONS

A.E. SIEGMAN, Stanford University, School of Hum. & Sciences, *Palo Alto, California* 94305 (DF044130; AF-AFOSR-3043-76)

AF function - navigation, guidance and control of aircraft, spacecraft and missiles require sensors for angular rotation rate in inertial space. Deficiency - the coming use of ring lasers in platform and strapdown systems poses problems of cost, size and reliability. With the He-Ne lasers presently used in ring laser gyroscopes problems of shelf and operating life, plasma noise, striations and Langmuir flow hamper application or increase cost. Objective - investigate the possibility of replacing the He-Ne laser by a newly developed optically pumped 546.1 nm Hg laser. How work contributes - this laser system appears to be very promising as an alternative, and a very stable, long-lived, low pump-power medium, rendering potentially better performance and reliability at lower cost.

Concurrent with an ongoing basic research program, this additional research program would address the more developmental problem of optimizing the performance of the Hg laser system within the special constriants and requirements specific to laser gyro applications. Emphasis is on the experimental preparation of the Hg laser for such application, ring laser experiments being performed elsewhere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0011, NONLINEAR INTERACTIONS IN SUPERFLUID DYNAMICS - SUPERCRITICAL COUNTERFLOW AND SHOCKWAVES

H.W. LIEPMANN, Calif. Inst. of Technology, School of Engineering, *Pasadena, California* 91109 (DF040450; F44620-75-C-0038)

AF function - the proposed research primarily falls in the 4.2 and 5.3 ROS which deal with the determination of the air flow characteristics associated with aircraft and missiles and the generation of usable electric power from non-nuclear energy sources. In particular research into the development of turbulent boundary layer and heat transfer in liquid helium to keep the superconductor generator cool is a basic air function. Deficiency - the majority of practical flight conditions occur at velocities and altitudes for which the boundary layer is turbulent; however, accurate and analytical techniques exist only for the laminar case. Research is required on the fundamental process of turbulence. The development of superconductive rotating electrical power generators and pulsed superconductive energy storage systems required the ability to keep the system cool. The investigations into heat transport of liquid helium is of prime importance. Objective - the objective of the research is to continue the investigation of HeII turbulence, in particular, to investigate the motion of thermal shock waves and corresponding nonstationary heat transfer. Contribution -this research is a part of a comprehensive program in superfluids and superconductors.

The critical velocities in HeII and the onset of turbulence are of primary interest in the proposed investigation, and are based upon previous experience and results. It is proposed to study the critical heat flux in HeII by experiments with finite-amplitude second sound waves, i.e., thermal shock waves. The velocity in the wake of a second sound shock is uniquely related, through the two-fluid equations, to the speed of the shock. Consequently, thermal shock waves in HeII can be used like ordinary pressure shocks in gases to explore the variables of state. The application of thermal shock wave studies to the exploration of the critical velocities supplements steady-state experiments of heat transfer in two ways. The transition induced by a thermal shock occurs in the absence of solid boundaries, and hence, vortex nucleation problems on solid walls are absent. Second, the rise-time in temperature in a thermal shock is fast and permits the investigation of finite relaxation times in the breakdown of the superfluid state.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012, HUMAN FACTORS ENGINEERING

R.A. ERICKSON, U.S. Navy, Weapons Center, *Ridgecrest, California* 93555 (DN482058)

To perform human factors engineering, research, and development on aircraft weapon systems and subsystems, including associated target acquisition display systems.

Mathematical modeling, human factors analysis, laboratory experiments, and flight tests will be conducted as appropriate to relate control, display, and sensor system characteristics to operator/aircrew performance. Analysis will be conducted to evaluate the observer submodel of several mathematical models of target acquisition by forward-looking infrared systems (FLIR), and to develop an improved submodel based upon available experimental data. In-house and contracted laboratory research will be conducted on ship identification with a raster imaging system. Television adjusted to simulate FLIR imagery will be used to measure operator performance as a function of signal-to-noise ratio, horizontal and vertical resolution and target aspect. The usefulness of color coding symbology, scales, and alpha-numbers in strike aircraft cockpit displays will be evaluated in laboratory experiments.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0013, TRANSONIC WALL JETS

N. MALMUTH, Rockwell International Corp., *Thousand Oaks, California* 91320 (DN675217; N00014-76-C-0350)

Increased emphasis on propulsive lift devices in advanced naval aircraft has stressed the need for an enhanced understanding of the underlying fluid dynamics processes which control the degree of force augmentation that can be avhieved. The planned research will develop a methodology for predicting the flow field about an airfoil containing a transonic wall jet representative of a class of propulsive lift devices.

The interaction of the transonic wall jet with the surrounding flow will be computed for flow fields with increasing degrees of complexity. Initially a jet discharging into ambient air will be treated; viscous effects will be neglected both at the wall and at the outer slip line. Increasing complexity will be added in stages in the form of, first, an external flow and, subsequently, viscous mixing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0014, LASER SPECTROSCOPY OF SOLID-STATE ELECTROLYTES

J.F. SCOTT, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (DF046000; AF-AFOSR-3105-77)

AF function - this proposed research primarily falls in the 5.3 research objectives which deal with electrical power from non-nuclear energy sources. In particular, the use of superionic conductors as solid electrolytes has high potential for development of new batteries and energy storage devices. These batteries will be used for electrical power in manned and unmanned aircraft, satellites and space stations, as well as electrical power unattended ground-based systems. Deficiency -substantial improvements are needed in organic and solid electrolytes to increase conductivity to that achieved in aqueous electrolytes. These solid electrolytes have a much wider temperature range and are needed to be used in new high energy, high charge and discharge rates rechargeable batteries in future aircraft applications as well as space applications. Objective - it is proposed to study the solid-state electrolytes penta-pyridinium silver-iodide, silver-iodide tungstate, and related materials by the technique of laser spectroscopy. Solid-state batteries developed at sandia in 1972 offer significant advantages over conventional thermal batteries: lower operating temperatures, wider temperature range of operation, simpler chemistry, non-hygroscopic materials, and the ability to withstand large external forces. The objective is to develop a material with these characteristics with the higher current and energy density characteristics of conventional batteries. Contribution - this research is a part of a comprehensive program in superfluids and superconductors.

The approach to be taken is to characterize the spectral response of solid-state electrolytes from about 1H sub 2 to 10 to

the 14th power H sub 2, in a nearly continuous fashion. To do this double and triple monochromators, optical furnaces cryostats, argon and krypton lasers, trip-passed Fabry-Perot and autocorrelation spectroscopy apparata with on-line computer will be used. It is proposed to make optical studies of two silver-iodide based solid-state electrolytes-penta-pyridinium silver-iodide, a two-dimensional electrolyte analogous to B-aluminas, an Ag (13) I (9) W (2) 0 (8), a new system whose structure was only recently determined at the University of Colorado. Comparison of this spectra of Ag (13) I (9) W (2) 0 (8) with Ag (2) W 0 (4), which has recently been grown as large single crystals, will be made. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0015, HEAVY PAYLOAD PROGRAM

E.T. BYRAM, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN480104)

Develop and fly heavy space instrumentation matched to the capability of large low-cost carrier rockets (ARIES) and of large satellites (HEAO and the shuttle).

In the X-ray, gamma-ray region evaluation of emission from the natural background and from man-made objects profits from the increased sensitivity provided by large detectors. Pointed payloads and large sensors are developed and used: (1) to define the limits placed by nature on space military systems, (2) to augment technology for inspection of man-made objects in space, and (3) to study physical processes and systems not possible to study from the ground.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0016, ENVIRONMENTAL SUPPORT TECHNOLOGY - THE RADIATION BACKGROUND AT HIGH ALTITUDES & ITS EFFECTS ON COMMUNICATIONS

M.M. SHAPIRO, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN620056)

(1) To make military communications more reliable by acquiring data that will improve the predictability of magnetic storms, polar blackouts, and the interruption of communications during solar flares. (2) To provide timely advice and assistance to NRL scientists and engineers working on those military problems in which knowledge of high-energy physics and its specialized experimental techniques is essential, together with expertise on radiation backgrounds.

Sensitive detection systems are sent aloft in balloons and satellites to study the composition, production mechanisms and sources of the various components of the high-energy particles impinging on earth. Their collisions, multiplication, and energy deposition are investigated to permit evaluation of radiation damage and hazards to high-flying personnel and military systems (e.g., in the SR-71. Accelerator-produced heavy ion beams are used for calibration.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0017, FAILURE OF METAL MECHANICAL JOINTS UNDER BLAST LOADS

C.A. ROSS, State University of Fla. Sys., School of Engineering, *Gainesville, Florida* 32611 (DF047900; AF-AFOSR-3237-77)

AF function - to add needed knowledge in the area of aerospace vehicles, propulsion systems and weaponry. The failure of structural elements because of damage by dynamic blast loads is phenomenologically complex and improved modeling methods are badly needed. Deficiency - in aerospace applications, the boundaries of many structural elements are bolted or riveted joints. As such, these joints are not to be traditionally modeled as fixed, simply supported or free conditions. In addition, computer modeling of these complexities has proven to be cost prohibitive. Therefore, a deficiency exists and work must be done to overcome same. Objective - this research will use energy methods as a prerequisite study procedure for analytical modeling of joint degradation from blast loads. Through the use of energy methods and analytical modeling, a better understanding of mechanical joints should evolve. How work contributes - additional scientific information about joints will serve to improve aerospace vehicles, propulsion systems and weaponry devices. In this way, better Air Force systems will be the long-range result.

Initially, Dr. Ross proposed to attack the problem by doing slow-to-intermediate strain rate studies using conventional property test methods. An in-depth literature search was also included in the initial task. In this expanded effort, Dr. Ross proposes to include analyses of plate stiffness with added stringer or rib stiffeners for a controlled response of panels between essentially fixed boundaries (bulkheads or forming rings).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0018, LOW-FREQUENCY AUGMENTOR INSTABILITY INVESTIGATION

J.P. RUSNAK, United Technologies Corp., *West Palm Beach, Florida* 33402 (DF459330; F33615-76-C-2024)

To analytically and experimentally identify the mechanisms and contributing factors leading to the onset and existence of low-frequency combustion instabilities in turbine engine augmentors and duct burners. The principal oscillatory frequencies of interest in this study are those below 300 Hz.

This is the first of a series of two procurement actions which result from this program. Part I provides the analytical and experimental development of a mathematical model to predict low-frequency instability in reacting flow. Part II is an in-depth investigation of the heat release at the flameholder subject to longitudinal pressure disturbances.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0019, UNSTEADY VISCOUS FLOW

J.C. WU, Georgia Inst. of Technology, School of Aerospace Engin., *Atlanta, Georgia* 30332 (DN575103; N00014-75-C-0249)

The prediction of the gust response, dynamic stability and flutter characteristics of aircraft and missiles requires an accurate knowledge of unsteady aerodynamic flows. Because of the complex nature of such flows when viscous effects are important, coupled with the limited availability of reliable measurements, serious shortcomings exist in existing predictive methods. The objective of this research is to use numerical solutions of the Navier-Stokes equations to assess the assumptions, approximations, and ranges of validity of existing inviscid theories for oscillating airfoils.

In this research an integro-differential formulation of the incompressible Navier-Stokes equations will be used to compute the complete history of the viscous flow field development about an airfoil undergoing sinusoidal oscillations in sufficient detail to permit the delineation of the various flow features, including the periodic shedding of vortices and the accompanying change of circulation, and the periodic variations of pressure, forces and moments. Calculations will be made for a range of frequencies appropriate to aircraft and missile flight. Corresponding inviscid calculations will be used for assessment purposes.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0020, ELECTROMAGNETIC SCATTERING AND DIFFRACTION PROBLEMS FOR PERFECTLY CONDUCTING OBJECTS

P.L. USLENGHI, Univ. of Illinois, School of Engineering, *Chicago, Illinois* 60680 (DF034000; AF-AFOSR-2263-72)

It is important to resolve the current problems of electromagnetic transmission, reception, environment and reflection, associated with aerospace vehicles and equipment. Specific concerns include the development of techniques to decrease the electromagnetic effect introduced by an object, to reduce the radar reflectivity and emmissivity of the object, to enhance vehicle detection, and to improve the efficiency and design of aerospace radomes and antennas. In particular, this includes the development of new mathematical methods to characterize the elec-

tromagnetic effects caused by the shape of an object. This is the principal goal of this research program. New extensions and applications of the geometrical theory of diffraction to the scattering of electromagnetic waves by perfect conductors and inhomogeneous dielectrics are being investigated. Specific shapes considered include objects having surface elements parallel to the direction of plane wave incidence, in particular the right circular cylinder of finite length viewed at or near axial incidence, and the circular disk at grazing incidence. These investigations employ the theory of turning points for second order differential equations. The program is being conducted jointly with professor T. B. A. Senior of the University of Michigan.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0021, GRAPH THEORY AND COMBINATORICS WITH APPLICATIONS TO DIGITAL SYSTEMS AND NETWORKS
S.L. HAKIMI, Northwestern University, Technological Institute, *Evanston, Illinois* 60201 (DF043670; AF-AFOSR-3017-76)

AF function - the design of complex networks, such as in electrical transportation, and communications systems. Deficiency - the knottiest problems in this field are combinatorial, and existing methods are relatively few and they do not form a unified theory. Objective - the objective of this research is to develop analysis and design methods that will be useful in solving the various types of network problems. How work contributes - success in this research could lead to significantly better logistics and communications systems in the Air Force.

The main tool will be the theory of graphs, a fairly new field with few experts, but which has surprisingly many applications to sundry and disparate concrete problems. Emphasis will be placed in the areas of invulnerable communications networks, the construction of codes exhibiting high degrees of automatic error detection or error correcting capability, and digital systems and their fault diagnosis and correction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0022, INVESTIGATION OF AERODYNAMICALLY INDUCED VIBRATIONS
S. FLEETER, General Motors Corporation, *Indianapolis, Indiana* 46206 (DF046830; F49620-77-C-0024)

AF function - advanced turbomachinery. Opportunity - develop predictive capability for blade flutter. Objective - develop a valid experimentally verified, quantitative basis for the design of turbomachinery blades that are free of high-magnitude, aerodynamically induced, integral order stresses. How work contributes - this work will permit designers to more accurately consider aerodynamic flutter in the design of advanced turbomachinery.

The DDA low-speed, large-scale single-stage research compressor will be used to investigate the effect of rotor-stator axial spacing on the fundamental unsteady aerodynamic phenomena in the vane row generated by the passage of the rotor wakes. The experimental data will be analyzed and correlated with appropriate state-of-the-art analyses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0023, LASER VELOCIMETER MEASUREMENTS & ANALYSIS IN TURBULENT & MIXING FLOWS
H.D. THOMPSON, Purdue University, Purdue Research Foundation, *Lafayette, Indiana* 47907 (DF461070; F33615-77-C-2010)

To experimentally and analytically investigate the biasing of individual realization LDV signal and to investigate the feasibility of the use of fluorescent dye tracers in the study of mixing and turbulence.

The effort shall include the further development of existing turbulence and mixing models, the identification of the LDV signal biasing associated with the models and the development of carefully controlled experiments to measure the biases in actual flows. A suitable experiment shall be defined and carried out to determine the feasibility of the use of fluorescent dye tracers in the study of mixing and turbulence.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0024, DIGITAL ELECTROHYDRAULIC STEPPER ACTUATOR FOR ADVANCED MISSILE SYSTEMS
L. MAYER, Bendix Corporation, *Mishawaka, Indiana* 46544 (DF457070; F33615-74-C-2052)

The purpose of this advanced technology program is to investigate a new technique in achieving a digital interface compatibility while still achieving the required performance characteristics in a volume and weight permitted in an airborne missile. The requirements for this actuator program have been taken from design studies conducted by Martin, Orlando Division, on the multi-purpose missile. However the technology from this program will be applicable to all future high-performance missiles and RPVs.

The program includes design, fabrication assembly and testing of the electrohydraulic digital stepper actuators.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0025, UNSTEADY AERODYNAMIC FORCES ON HIGHLY CAMBERED AIRFOILS MOVING THROUGH GUSTS AT ARBITRARY ANGLE OF INCIDENCE
H. ATASSI, Univ. of Notre Dame, School of Engineering, *Notre Dame, Indiana* 46556 (DF038600; AF-AFOSR-2675-74)

AF function - advance turbomachinery. Opportunity - improve ability to predict aerodynamic forces on compressor blades. Objective - develop a technique to determine angle of attack, camber, and thickness effects on the unsteady dynamic response of turbomachinery blades. How work contributes - will provide method to more accurately calculate flutter conditions in compressors.

A method will be formulated for calculating the unsteady aerodynamic forces and pressure distribution on a thick oscillating airfoil with lift. The unsteady aerodynamic forces on highly cambered airfoils moving through gusts will be determined. Finally the unsteady flow response of a cascade of highly cambered blades will be determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0026, QUASI-ORDERED STRUCTURES IN FREE TURBULENT SHEAR FLOWS
T.J. MUELLER, Univ. of Notre Dame, School of Engineering, *Notre Dame, Indiana* 46556 (DF049660; AF-AFOSR-3412-77)

AF function - aerospace vehicles. Opportunity - flow visualization by use of smoke streams can be an excellent method to elucidate the intricate flow patterns for both viscous and inviscid flows. Professor F.N.M. Brown at the University of Notre Dame produced many such visualizations but his results were not widely published. These results and the techniques to produce them should be published to aid present and future experimental aerodynamicists. Objective - to assemble a complete survey of subsonic and supersonic smoke visualization results along with techniques and equipment needed to produce them. How work contributes - new analytical models and numerical computational methods are required to provide more efficient designs for advance aerospace vehicles. Improved visual studies of practical fluid dynamic problems can link the meaning between the measured flow parameters and the governing flow parameters by providing observed flow patterns for the desired ranges.

A wealth of knowledge concerning visual flow results and techniques are available but must be disseminated to be of use. This effort will collect this trove of information in a concise usable report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0027, HIGH-ENERGY Q-SWITCH
W.W. HUGHES, Westinghouse Electric Corp., *Baltimore, Maryland* 21203 (DF103160; F33615-76-C-1015)

The trend in future AF laser target designators and countermeasures is towards higher energy per pulse (more than 0.5 J/pulse). The simplest approach to achieve this is to use higher energy storage laser materials in combination with a thermal optic distortion relief design. This makes it even more important that the q-switch have a high damage threshold. The objective of this program is to develop a high-energy density-resistant q-switch for 1.06 micron lasers delivering more than 0.5 J/pulse. In order to build simple reliable laser sources for future 1.06 micron target designator and countermeasure systems, a high-energy density-resistant q-switch will be required. The design of the q-switch must allow use of pim and doublet coding techniques. The tentative objective performance requirements are as follows: damage threshold, more than 500 mw/cm2, extinction ratio, more than 300/1, repetition rate, to more than 30 pps. The switching speed must be fast enough to allow generation of 20-30 nsec pulses.

Several approaches to this program are possible. The most straight-forward approach would be to simply attempt to improve the performance of the Kd P q-switch. This approach does not offer much in the way of future growth possibilities. The use of a new electrooptic material such as Cd A is a definite possibility. This material has a potentially high damage threshold and low voltage requirements. However, there are difficulties in growing satisfactory crystals. The material growth problems are being addressed in another program. A third very promising approach is the FTIR (frustrated total internal reflection) q-switch. The basic feasibility of this approach has been demonstrated and the future growth possibilities are excellent.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0028, UNSTEADY TURBULENT BOUNDARY LAYER BY WIND TUNNEL EXPERIMENTS

E. COVERT, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DF047010; F49620-77-C-0031)

AF function - advanced aerospace vehicles. Opportunity - gain further understanding of unsteady boundary layers. Objective -investigate the unsteady boundary layer phenomena induced on a fixed, stationary, two-dimensional airfoil. How work contributes - better knowledge of the unsteady mechanisms of a turbulent boundary layer will contribute understanding of flutter, buffeting and stall flutter, all common problems for air foils used for helicopter blades, rotating machinery blades and fixed-wing aircraft lifting surfaces. The data obtained from this effort will be directly applicable to the design of future aerospace vehicles.

An experimental program will be established with the following goals: 1) establish a boundary layer on a well-documented airfoil in a steady primary flow and provide an unsteady local outer flow, 2) take quasi-steady pressure coefficient and boundary layer parameter measurements for comparison with the unsteady flow data to select the test geometries required to produce the unsteady local flows, 3) select the optimum configurations and take experimental measurements of the turbulent boundary layer properties such as velocity profiles, fluctuation pressure and local skin friction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0029, THREE-DIMENSIONAL COMPRESSIBLE FLOW THROUGH HIGHLY-LOADED AXIAL COMPRESSOR BLADE ROWS

J.E. MCCUNE, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DF040230; AF-AFOSR-2784-75)

AF function - advanced gas turbine engine technology. Deficiency -lack of fundamental knowledge of flows through rotating turbomachinery. Objective - develop a technique to predict the flow conditions for highly loaded (high angle of attack) annular cascades in transonic flow. How work contributes - better knowledge of flow fields through turbomachinery will allow the designer to improve present empirical techniques used in designing advanced turbomachinery compressors and turbines.

A step-by-step procedure is being followed. It is as follows: 1) development of method for three-dimensional incompressible flow through annular cascade, 2) development of method for three-dimensional compressible flow through annular cascade, 3) comparison of results with experiments, 4) generalization of methods to include nonuniform inlet conditions and viscous effects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0030, FUSION CASTING FLUORIDES

J. PAPPIS, Raytheon Company, *Waltham, Massachusetts* 02154 (DF901450; F19628-76-C-0279)

AF function - weaponry. Deficiency - inability of currently available materials for laser windows to passively withstand laser power. Objective - to use fusion casting of alkaline earth fluorides to produce low-absorption, high-strength laser windows. How research contributes - alkaline earth fluorides are leading candidates as laser window materials. This contract will optimize casting procedures and purification techniques for calcium fluoride, strontium fluoride and barium fluoride to produce 15 cm diameter laser windows having high strength, low absorption and low residual strain.

The approach to this research is to simultaneously purify and cast the alkaline earth fluorides in the same apparatus using reactive and nonreactive atmospheres. Castings will then be characterized to determine impurity content and optical absorption.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0031, STUDIES IN THE VISCOMETRY OF SLOW MOTIONS OF RHEOLOGICALLY COMPLEX LIQUIDS 12754-E

D.D. JOSEPH, Univ. of Minnesota, School of Engineering, *Minneapolis, Minnesota* 55414 (DA0R5579; DAAG29 76 G0047)

To perform experimental and mathematical studies on the mechanics of flow of rheologically complex liquids; to develop sets of standard experiments which will lead to reliable viscometric data characterizing rheologically complex fluids. Relevance - the flow properties of hydraulic fluids and lubricants to weapon systems and vehicles are of great importance to the Army. In particular, application to the design of recoil mechanisms, hydraulic power transmission, and the lubrication of aircraft and tank components are obvious examples.

Starting from Noll's formulation for the so-called 'simple' fluid and specifying classes of motion or histories in which the stress response functional is manageable, various types of viscometric flow will be solved and checked experimentally.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0032, NOVEL DIGITAL SIGNAL PROCESSING AND DETECTION TECHNIQUES

B. LIU, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DF044760; AF-AFOSR-3083-76)

AF function - to advance the theory and design of digital signal processing hardware and techniques for use in Air Force electronic communications and surveillance systems. Deficiency - ever more stringent requirements in the areas of communications, reconnaissance, radar navigation, and flight control create corresponding demands in the area of signal processing. The high prices now paid in weight, size, power consumption can and must be reduced - higher speeds and accuracy are needed as well. Objective - to discover new structures for signal processors, to devise better ways of processing two-dimensional signals, and to find improved statistical methods that can be implemented for signal detection. How work contributes - the results of this research could be directly usable in the design of future Air Force electronics equipment.

New filter structures will be studied in connection with adaptive signal quantization. The roundoff error will be investigated in a new class of fast algorithms for the convolution and DFT. Work will continue in the study of sequential sampling in hypothesis testing applied to detection.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0033, DEVELOPMENT OF REAL-TIME VIDEO TRACKING CONCEPTS 13857-EL

G.M. FLACHS, New Mexico State University, School of Engineering, *Las Cruces, New Mexico* 88003 (DA0E9145; DAAG29 76 G0231)

To develop concepts and techniques for performing picture decomposition, initial target acquisition, multiple target tracking, and structural recognition required to automatically track targets with a TV camera control system. Relevance - successful completion of this research effort will result in configuration of a system that will substantially improve the cost-effectiveness of optical data collection and processing, and greatly increase the effectiveness of all DoD missile and aircraft flight testing programs.

Initial efforts in these areas have established effective methods that have demonstrated real potential in tracking a limited class of targets. The research proposed extends the present techniques to a larger class of targets, and establishes firm scientific foundations for the development of reliable and fast target tracking algorithms capable of handling the real-time tracking environment.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0034, UNSTEADY BOUNDARY LAYER FLOWS

J.G. HALL, State University of New York, Graduate School, *Albany, New York* 12203 (DF039360; AF-AFOSR-2719-74)

AF function - aerospace vehicles. Opportunity - of prime interest for the future will be the ability of the scientist and engineer to model flows with unprecedented accuracy, thereby minimizing the costly consequences of small errors in estimating the static and dynamic loads over a wide variety of shapes and configurations. The major communicating link between a body and the moving fluid in which it is immersed is the boundary layer. An important unresolved feature of this boundary layer is its stability and transition to turbulence in response to time-varying (unsteady) inputs such as might result from a maneuver. While the mean characteristics of the unsteady laminar boundary layer have been studied to some extent and are believed to be reasonably well understood, the transition of this laminar boundary layer to turbulence and the turbulent boundary layer which develops from this unsteady initial laminar flow have not been looked at in any detail. A unique way of studying, experimentally, the stability of unsteady viscous flows, particularly of transient as distinct from periodic flows, is by use of a Ludwieg tube as anticipated in this research effort. Objective - to study analytically and primarily experimentally the stability and transition characteristics of unsteady laminar wall boundary layers as well as the features of the turbulent flow at long times following passage of a finite wave over an observed measuring station in a Ludwieg tube. How work contributes - a major objective of this research effort will be to exploit the great flexibility of the expansion (Ludwieg) tube as regards independent variations of pertinent flow conditions which determine the basic similitude parameters.

The experimental program has concentrated on obtaining transition-time data by thin-film detection for a range of the parameters involved. It appears desirable to employ other diagnostic techniques as well. For that purpose a special hot-wire probe is under construction and will be used to sense velocity fluctuations within the boundary layer itself. The theoretical investigation of the expansion wave boundary layer stability is based on a linearized small disturbance analysis using the method of multiple scales.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0035, UNSTEADY BLADE ROW IN HIGH-SPEED FLOW

M. KUROSAKA, General Electric Company, *Schenectady, New York* 12305 (DF038320; F44620-74-C-0040)

AF function - advanced turbomachinery. Opportunity - develop an analytical method for predicting the aeroelastic stability of compressor and turbine blades. Objective - to develop and establish an accurate analytical method for predicting the aerodynamic forces acting on the oscillating airfoils in a compressor. How work contributes - will provide an analytical method which is presently not in existence. Flutter limits are determined experimentally.

An analytical model will be devised to predict oscillatory forces acting on unsteady supersonic airfoils. As a first step it was assumed that the flow was inviscid and two-dimensional and the airfoils were flat plates. As a second step the limitation of the flat plate was removed and the effect of airfoil shape included. The third step examined the effect that back pressure has on the flow through the cascade. The final step will be to examine the effect of three-dimensional flow.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0036, MEMORY FOR RADAR

G. AMELIO, Fairchild Camera & Instr. Corp, *Syosset, New York* 11791 (DF092230; F33615-73-C-1044)

The digital approach to high-resolution synthetic aperture radars requires large amounts of memory for both the radar processor and scan converter. Minimization of the initial cost as well as the total cost of ownership of such systems requires that they be based on an extremely low-cost memory device which is reliable, small in size, and dissipates little power. The objective of this program is to develop an extremely low-cost CCD shift register memory chip which can be configured into SAR processors and scan converters. The low-cost requirement necessitates the development of a reliable memory device which has widesparead applications in addition to radar systems and which eventually will be made available on the commercial memory market.

A 32K bit CCD memory chip will be developed with an access time sufficiently short to allow widespread military and commercial use. During this two-year program the following tasks will be performed: (1) analysis of memory system designs and their influence on chip organization (6 mos), (2) design and fabrication of the memory chip and the required intermediate test structures (15 mos), and (3) the design and fabrication of a 100K bit memory module (3 mos). A line addressable random access memory (LARAM) chip organization has been chosen as the best candidate vehicle for this program. The program will result in the feasibility demonstration of the CCD memory chip and module, and the generation of sufficient applications data to permit the design of various radar memory systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0037, RESEARCH ON INVESTIGATION OF THE BOUNDARY LAYER BEHAVIOR ON TURBINE AIRFOILS

L.S. HAN, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DF451660; F33615-75-C-2052)

This is a 24 month exploratory, experimental and analytical program to determine the influence of upstream airfoil wakes on the transition behavior of the turbine airfoil boundary layer and to develop an analytical method of prediction of wake velocity profiles at various positions downstream of the trailing edge.

A necessary step in the development of cooling technology of rotor blades is to experimentally ascertain the combined influence of upstream wakes, high levels of turbulence, pressure gradients and surface curvature on the initiation and development of transition in the boundary layer. The ground work for this study has been developed under contract F33615-75-C-2033 and provides data on the effect of wakes from an upstream cascade on the flow around and behind a cascade of turbine airfoils in terms of pressure profile changes and shifts in the velocity profiles of the airfoils' wakes. Detailed experimental investigation of the transition regions locations and characteristics, as well as an accurate knowledge of the stator wake and freestream turbulence characteristics, are now necessary to determine the relative influence of the relevant factors on the boundary layer development.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0038, COMPUTATIONAL FLUID DYNAMICS

W.L. HANKEY, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF136270)

A deficiency exists in the ability to compute 3-d flow fields. The objective of this investigation is to develop three-dimensional numerical methods applicable throughout the flight corridor to solve the set of partial differential equations for fluid mechanics. The current design technique for developing a new USAF system requires approximately 20,000 wind tunnel test hours, $50 million, and takes 4 years to accomplish. Use of numerical methods in the various phases of design can dramatically shorten this cycle.

In the past decade remarkable advances have occurred in the numerical computation of fluid flows. Advances in both computation methods and computer hardware have made this progress possible. The approach will be to develop numerical codes to efficiently solve various forms of the Navier-Stokes equations on the advanced computers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0039, AVIONICS LIFE-CYCLE COST

R. HARRIS, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF098130)

Obtain and develop costing methods, models and data base for evaluating and predicting avionics development, acquisition and logistics support cost elements. Apply methods, models and data base to life-cycle cost analyses in support of AFAL programs. The capability to evaluate and predict avionics cost-of-ownership will provide for the integration of cost factors in the design trade-off process thereby leading to a proper and acceptable balance between avionics performance and cost.

The approach to be taken in pursuit of stated objectives includes the following activities: (1) develop data base for logistics support cost experienced by present systems utilizing AFLCS IROS (K-051) data files, (2) develop data base for acquisition of present systems, (3) develop data base establishing non-recurring (R&D) portion of program unit cost of acquisition, (4) develop predictive cost models or estimating relationships (ERS) for system development, acquisition and logistic support using historical data relating performance, production and reliability trends and associated cost.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0040, CHAFF CLOUD MEASUREMENTS, ANALYSIS, AND DEVELOPMENT

R.J. PUSKAR, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF096990)

The objectives of this IH effort are (1) to develop realistic computer models of chaff clouds that account for critical aerodynamic and electromagnetic effects, (2) to obtain and analyze radar cross section data from measurements of actual chaff clouds, (3) and to perform lab experiments and simulations to determine the signature of new chaff elements and their effects on advanced radars.

The objectives are to be achieved by IH work and by utilizing and combining the work of various contractors. For example, computer programs to compute the RCS of a chaff cloud are being combined with aerodynamic programs that predict chaff element trajectories so that a time-varying RCS can be computed. In addition, IH measurements of the RCS of re-designed chaff will be performed to evalute the improvements in electromagnetic performance. Measurements of the RCS and Doppler return from chaff clouds will also be performed and analyzed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0041, FLUID POWER COMPONENT SURVIVABILITY

E.C. FITCH, Okla. St. Univ., School of Engineering, *Stillwater, Oklahoma* 74074 (DN675019; N00014-75-C-1157)

The objective is to conduct wear test on rotary mechanisms and different types of fluid power pumps to produce data to better understand the fundamentals of wear in hydraulic systems, and determine the factors involved in life improvement through filtration by the system filter. Also, investigate and identify aspects for calibration of ferrographic equipment. Investigate the effectiveness of various filtration devices.

The approach will be to determine the effect of varying the concentration and size of particulate contamination on clearances. Contamination level will be controlled as well as the clearances. Wear test will be conducted using selected filter configurations for mechanism protection and compare results with unprotected mechanisms tests.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0042, LOAD AND ENVIRONMENTAL INTERACTION IN FATIGUE CRACK GROWTH UNDER SPECTRUM LOADING

R.P. WEI, Lehigh University, School of Engin. & Phys. Sci., *Bethlehem, Pennsylvania* 18015 (DF041550; AF-AFOSR-2857-75)

AF function - to contribute to an improved understanding of failure processes for structural materials so that useful serviceability might be optimized. In this way, Air Force flight vehicles will be substantially benefited. Deficiency - a better understanding about flaws and their associated effects will allow design engineers to reliably predict flight worthiness. Objective - this research effort is indicated to an experimental study of fatigue crack mobilities under different thermal and chemical environs over a range of load conditions. How work contributes - more knowledge about the behavior of structural materials under fatigue loadings should certainly improve Air Force flight systems and their components.

Experimentally, specimens of Ti-6Al-4V and 2219-T851 Al alloy will be evaluated using wedge-opening-load specimens under different fatigue conditions and environs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0043, PROCESSING OF ADVANCED ELECTROMAGNETIC WINDOWS - CHEMICALLY VAPOR DEPOSITED SILICON NITRIDE

R.A. TANZILLI, General Electric Company, *Philadelphia, Pennsylvania* 19101 (DN675314; N00014-76-C-0547)

Future naval tactical missiles will need IR domes, radomes, and perhaps even dual-mode capabilities in the same electromagnetic transparency. Presently used materials are not suited for use in such systems because the operating environment will impose severe conditions such as mechanical and thermal loading, impact-caused erosion, and optical or electrical property changes beyond the useful capabilities they possess. In addition to possessing useful mechanical, thermal, optical, electrical and chemical properties, such materials must have the potential for fabricability demonstrated. This task is investigating areas of processing development, materials characterization and property determinations which will establish the suitability of CVD Si3N4 as a potential electromagnetic window.

Process studies aimed at increasing deposition rate, thickness and yield of useable material for further property characterization (optical, electrical, mechanical, especially at elevated temperatures). Deposition rates greater than 1 mm per hour are being investigated, with silicon tetrachloride reactant, free of surface irregularities at thicknesses up to 5 mm, and with silicon tetrafluoride in order to increase conversion efficiency. Variables to be investigated include feed geometry, substrate material, deposition geometry and pressure. Characterization of chemical effect (oxygen content) on transparency of CVD silicon nitride is being completed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0044, EDGE FUNCTION METHOD OF STRUCTURAL ANALYSIS

P.M. QUINLAN, Natl. University of Ireland, *Cork, Republic of Ireland* (DF289360; AF-AFOSR-2768-75)

AF function - structural design/analysis of aerospace vehicles. Deficiency - present inability to mathematically represent

large structural sections in an efficient, inexpensive fashion. Present detailed analysis methods are applied primarily to structural details, areas of high stress concentration, etc. Research - Prof. Quinlan is currently developing the edge function method for boundary value structural analysis problems. In addition to his own research, he has access to data from other agencies and institutions on the application of the edge function method to specific areas such as vibration, thick plate, and fracture problems. His recent work in extending the analysis technique to the 3-d case promises to be a significant technical achievement and could be of great value to the structural design/analysis task. How research contributes - could provide an alternative, and much less costly, method of mathematically describing complex, large-scale, structural assemblies.

Mathematical parameters for the edge function method will be defined. Conditions under which the method can be applied will be obtained.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

4.0045, STORE LOADS CORRELATION

R.E. DIX, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF420911; F40600-75-C-0001)

Since normal force and pitching moment exert significant influence on the trajectory a store follows after release, it is important to correctly position the store with respect to the captive position during wind tunnel tests. This positioning technique needs to be refined for both internal-balance support and dual support tests. In addition, both internal support and dual support methods require correlation with flight test data to establish their validity.

A wind tunnel test program will be conducted in the PWT/4T wind tunnel to evaluate better bracket designs for both internal support and dual support testing. Flight test data obtained from the in-flight measurement of captive loads acting on a dummy MK-83 store will be correlated with wind tunnel captive loads previously obtained.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering & Development Center

4.0046, NO EXHAUST MEASUREMENT

E.L. HIVELY, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF407060)

To resolve present discrepancies between optical, in-situ and extractive probe techniques for turbine engine emissions. To show the feasibility of simpler, less costly and more accurate measuring systems for turbine engine exhaust composition measurement.

A series of controlled laboratory experiments, beginning with well understood burner systems and progressing to more dynamically complicated combustion systems using JP-4 fuel will be run. Simultaneous measurements using newly designed optical and probe systems and existing optical systems will be made. Data reduction and analysis techniques will be emphasized. Joint funding by AFCEC, EPA, Naval Air Propulsion Test Center, NASA, and FAA. FAA will be lead agency for contract administration. Primary contractor will compare newly designed systems directly with systems presently used by AEDC and the Aeronutronic Ford Corp. Since ARO (AEDC) cannot subcontract for a civilian firm, AFCEC will directly fund ARO support of the primary contractor's efforts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Civil & Environmental Engineering Development Office

4.0047, DYNAMICS OF COMPLEX STRUCTURES - ANALYSES AND EXPERIMENTS

J.H. SMITH, Texas Tech University, School of Engineering, *Lubbock, Texas* 79409 (DF047380; AF-AFOSR-3231-77)

AF function - protection of Air Force flight systems from hostile action is an essential part of the Air Force mission. Scientifically based predictions of survivability/vulnerability for complex structures and their components is a difficult problem but one that can be solved with new and continued research. Deficiency - a scientific understanding of the failure mechanisms for complex structures does not exist and, certainly, not within the accuracy that is desired. To achieve the reliability and confidence levels necessary in designing protective structures, additional scientific studies are required to negate this deficiency. Objective - the purpose of this research effort is to provide basic information to the Air Force for use in their future predictions of survivability/vulnerability of complex structures and their components. More specifically, dynamic characteristics of damaged aircraft structures will be determined. How work contributes - results of this research will provide the Air Force with new and proven design tools for protective structures. Specifically, this work will experimentally study and develop a two-dimensional model for predicting the structural response of an aircraft stabilator under dynamic loading. The stabilator has been the chosen target of study because of handling ease, but the analytical techniques will be applicable to wing vulnerability studies.

Fundamental properties, such as resonant frequencies, mode shapes, and damping, will be evaluated for varying degrees and location of damage. The ultimate goal is to predict, with reasonable accuracy, what level of damage causes a significant or serious change in structural integrity. A two-dimensional discrete element mathematical model and corresponding computer code will be developed to accomplish this and each will be verified by extensive experimental testing of a particular aircraft component furnished by Eglin AFB - a horizontal stabilator. Specifically, the approach will be biased to accomplish the following independent activities: 1) to theoretically verify a technique of transforming a wing-type surface into an equivalent flat plate. Some of this theory development has already been accomplished by earlier work for AFOSR/ADTC so this phase will primarily be to validate the theory and modify it as necessary for this new problem of a stabilator, 2) to develop a two-dimensional computer analysis code. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0048, MECHANISM OF TURBINE ENGINE LUBRICANT DEPOSITION

P. CUELLER, Southwest Research Institute, *San Antonio, Texas* 78228 (DF458710; F33615-76-C-2020)

Develop theory that will lead to an understanding of, and ultimately describe the lubricant chemistry associated with the mechanism of lubricant deposition.

Develop test techniques using the precision research rig developed under 30480635, to precisely control and measure all test parameters. Observe oil deposition behavior using known lubricant basestocks and additive combinations. Compare results with analytical techniques being developed under 30480626.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0049, A MILLIMETER WAVE ATTENUATION AND DEPOLARIZATION EXPERIMENT USING THE COMSTAR AND CTS SATELLITES 14066-EL

C.W. BOSTIAN, Virginia Poly. Inst. & St. U., School of Engineering, *Blacksburg, Virginia* 24061 (DA0F8954; DAAG29 77 G0083)

To investigate precipitation-induced attenuation, depolarization, and differential phase shift using the CTS and Comstar satellites. Data obtained will be used to develop propagation path models which allow data obtained at one frequency to be scaled to other frequencies. Relevance - the Army is presently developing millimeter wave satellite systems. Results of this study will be directly relevant to the prediction of system performance parameters.

Simultaneous measurements through the same weather environment to insure identical meteorological parameters will be conducted at three frequencies. Data obtained will be analyzed to: (1) develop a statistical propagation model and (2) develop a theoretical model with the goal of reducing the discrepancies between theoretical expectations and experimental results.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0050, FILM COOLED NOSE TIPS FOR HIGH-SPEED MISSILES
A.H. NAYFEH, Virginia Poly. Inst. & St. U., School of Engineering, *Blacksburg, Virginia* 24061 (DN223402; N00014-75-C-0381)

For many flight conditions aerodynamic heating to the nose region of very high speed ballistic or maneuvering missiles causes geometry changes--changes which, though small, can result in severe problems in the dynamics of the vehicles. For such cases conventional ablation techniques are impractical and film cooling is seriously being considered as a solution. The purpose of this research will be to develop a nonlinear stability theory, valid for arbitrary liquid Reynolds numbers, to describe the waves generated on a thin transpired liquid layer by a high-velocity air stream.

Film cooling has been demonstrated to be an effective means for protecting the nose tips of very high speed missiles. However, because of the lack of an adequate description of the interaction of the air and the liquid layer and of the influence of the many factors affecting the stability of the liquid layer, contemplated designs must be overly conservative. The purpose of this research will be to develop a nonlinear stability theory to describe the liquid layer for arbitrary values of the liquid layer Reynolds number thereby removing the restriction of present theories to very low Reynolds numbers (order one). The external gas will be assumed to be viscous. It will exert a mean shear at the gas-liquid interface which, in turn, will establish a linear liquid velocity profile.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, EXPERIMENTAL AND THEORETICAL RESEARCH ON THE AURORA BOREALIS
M.H. REES, Univ. of Alaska, Geophysical Institute, *Fairbanks, Alaska* 99701 (ATM76-17409 A01)

This grant funds a theoretical and experimental study of the aurora. The experimental portion will make use of the new optical facility developed at the Geophysical Institute of the University of Alaska, while the major modeling computations will be carried out using the NCAR facility. The research uses an integrated approach, combining modeling and observations, in the following principal areas: 1. Helium emission in twilight and sunlit aurora. 2. N2 ion 1NG bands in twilight and sunlit aurora. 3. The O ion 3719 A emission. 4. Metastable nitrogen atoms in auroral chemistry. 5. Ion composition in aurora. 6. O2 concentration at high latitude by 6300 A twilight measurements. 7. Time-dependent studies of the aurora.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0002, REFURBISHMENT AND ENGINEERING SUPPORT OF RECOVERED ATTITUDE CONTROL SYSTEM AND UPDATING OF MIDAS PLATFORM LOGIC
C. CHALFANT, Space Vector Corporation, *Northridge, California* (DF248080; F19628-76-C-0278)

AF function - direct support of aerospace environmental research measurements program. Deficiency - lack of knowledge of rocket attitude control and behavior. Objective - to provide the Air Force with a refurbished, reliable, accurate and low-cost attitude control system (ACS) and Midas platform for sounding rockets. How research contributes - contributes significantly to the cost-effectiveness and scientific utility of rocket-borne payloads which probe the aerospace environment.

Refurbish recovered rocket-borne attitude control systems and provide ancillary engineering and launch support services. Additionally, update Midas platform electronic logic and retrofit into existing systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0003, AUTOMATIC WEATHER STATIONS FOR ANTARCTIC METEOROLOGICAL RESEARCH
A.M. PETERSON, Stanford University, Stanford Electronics Labs., *Palo Alto, California* 94305 (DPP78-00548)

Twenty automatic weather stations (AWS) will be constructed in 1978 and 1979 for use in Antarctica. During austral summer of 1978/79, three of these AWS will be installed between Dome C and Dumont d'Urville for a study of katabatic winds; four AWS will be installed near McMurdo Station for use in a mesoscale meteorology research project; and once AWS will be installed at Siple Station for field testing in heavy snow environment. During austral summer 1979/80, the remaining twelve AWS units will be installed in data-sparse regions along the Weddell Sea coast, the Bellingshausen Sea coast, and the Amundsen Sea coast. During austral summer 1980/81, the AWS units used in the katabatic wind study will be redeployed to the Dry Valleys area near McMurdo for a study of the climatology of that region. During the second through the fourth years of this project, the deployed AWS units will be visited annually for servicing and repair. The data collected by these AWS will be transmitted back to the U.S. via polar orbiting satellites for use by researchers and for archiving at the National Climate Center in Ashville, N.C.

Logistics support is required in austral summer 78/79 and 79/80 for two men to deploy the AWS. In AS 80/81 and 81/82, logistics support is required for two men to repair and service the AWS units in the field.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0004, NAVY ENVIRONMENT - OCEANOGRAPHIC MONITORING FROM AIRCRAFT
T.P. BARNETT, Univ. of California, Scripps Inst. of Oceanography, *San Diego, California* 92038 (DN475190; N00014-75-C-0152)

Variability, both short-term and long-term, in the temperature structure of the upper ocean has a pronounced effect on acoustic propagation conditions and hence on ASW operations. The objective of this project is to provide a better understanding of the structure and evolution in time of the sea surface temperature field and of the temperature structure of the mixed layer. This project is an integral part of the North Pacific Experiment (NORPAX).

Naval P-3 aircraft will be utilized in support of NORPAX field programs for purpose of ocean monitoring, primarily the upper-ocean thermal structure using calibrated Navy AXBT's (SSQ-36 sonobuoys), and secondarily sea surface temperature patterns using infrared sensors as well as surface currents using aircraft-tracked drifting buoys.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0005, LATITUDINAL STRUCTURE OF SOLAR WIND STREAMS FROM RADIO SCINTILLATION OBSERVATIONS
B.J. RICKETT, Univ. of California, Graduate School, *San Diego, California* 92037 (DF248790; F19628-77-C-0161)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate means to determine conditions within solar-wind streams. Objective - to recognize from coronal radio and optical observations which high-latitude coronal structures can give rise to solar wind streams in the ecliptic. How research contributes - provides the observational tools necessary to predict conditions in the solar wind as it affects the terrestrial space environment.

Observe the solar wind speed in and out of the ecliptic by the method of interplanetary radio scintillations and compare these

with geomagetic and coronal optical observations. These data will then be compared with spacecraft observed solar wind data to infer correlations among the various types of data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0006, DATA INTERPRETATION ON MEASUREMENT OF TRACE GASES

H.L. MAI, Univ. of Denver, Graduate School, *Denver, Colorado* 80210 (FA77WA-3949; FA59958 (TRAIS NO.))

The objective is to conduct a study and analysis to determine the error in deducing nitric oxide (NO) and nitrogen dioxide (NO2) altitude profiles as derived from infrared solar spectra obtained at high-altitude (25 to 35 km) balloon altitudes during sunset and/or sunrise and to prepare a report which explains the results obtained and discuss the importance of these findings in the context of a stratospheric ozone reduction estimation.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

5.0007, PROTON PREDICTION STUDIES

E. ROELOF, U.S. Navy, Sea Systems Command, *Washington, District of Columbia* 20001 (DF580280)

AF function - communications and surveillance. Deficiency - inability to predict solar proton intensities at the earth to the required accuracy. Research - develop techniques to predict solar proton flux at the earth's orbit. How research contributes - provide improved procedures and techniques that may be applicable to real time forecasting.

Procedures to predict the time history of solar proton fluxes in the immediate vicinity of the earth are to be developed from solar and interplanetary measurements. Utilizing the solar particle, interplanetary magnetic field, interplanetary plasma parameters and the available solar observational data, an analysis is to be performed to derive solar coronal injection profiles and interplanetary modulation effects that affect the time-intensity history of solar protons observed at the earth.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0008, SNOW SHOWER CLOUD PHYSICS IN THE LEE OF LAKE MICHIGAN

R.R. BRAHAM, Univ. of Chicago, School of Physical Sciences, *Chicago, Illinois* 60637 (ATM77-21464 A01)

The intense snow storms generated on the lee shore of Lake Michigan during early winter months, when cold air flows over the relatively warm lake, will be investigated using the CHILL dual-wavelength, Doppler radar and an instrumented airplane. Objectives include delineation of the internal circulation of the storm clouds and study of the cloud physics of snow nucleation and growth. The project will cooperate with an ERDA-sponsored study of air pollution scavenging by the same storms.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0009, MONITORING SOLAR WASTEWATER TREATMENT

R.C. CROCKETT, Wright Pierce Barnes & Wyman, *Topsham, Maine* 04086 (68-03-2587; B624B-534)

This is one of a multi-part project whose summary may be identical to others.

OBJECTIVES: The purpose of this contract is to determine the most energy-effective method of operating a municipal wastewater treatment plant using an integrated energy system of solar energy, digester methane, and heat pumps.

APPROACHES: The approaches for performing this project include: 1) Monitor and document the operational performance of the solar energy system including the collection, the storage, the transmittal, and the use of solar energy. 2) Monitor and document the operation performance of the anaerobic digester. 3) Gather data in appropriate climatic parameters and relate their impact on the solar energy system and digester supplemental energy requirements. 4) Identify each energy demand in the treatment plants as a percentage contribution of (a) solar energy, (b) digester gas, (c) heat pump, (d) effluent exchange, and (e) emergency electrical generation. 5) Identify the most cost-effective techniques for supplying plant energy demand through the combined use of solar energy, electrical power, and digester gas.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab.

5.0010, SPECTROMETER

R.P. CRABBS, Lee Ray Machine Co. Inc., *Baltimore, Maryland* 21208 (DF249970; F19628-75-C-0154)

AF function - environmental impact of high-altitude vehicles. Deficiency - effect of aircraft effluents on solar UV absorption and on ozone. Objective - to determine solar, ultraviolet energy deposition rates and ozone concentrations. How research contributes - energy deposition rates and ozone concentrations will improve models used in computation of environmental impact of Air Force vehicles.

Contractor shall design, fabricate and test a balloon-borne ultraviolet spectrometer for the measurement of solar radiation in the range between 2000 and 3100 Angstroms. After each balloon flight, the instrumentation will be refurbished and prepared for a subsequent flight. Four balloon flights of the solar spectrometer are planned to provide data on the solar spectrum as a function of height in the stratosphere. From these data, energy deposition rates and ozone concentrations will be computed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0011, VIBRATIONAL NITRIC OXIDE ION STUDY

M. CAMAC, Aerodyne Research Incorporated, *Bedford, Massachusetts* (DF243580; F19628-76-C-0178)

AF function - detection and surveillance. Deficiency - inadequate knowledge of the upper atmosphere during disturbed conditions, e.g., nuclear explosions and auroras. Research - the vibrational transfer rates to molecular nitrogen and molecular oxygen are measured for nitric oxide ions. How research contributes - nitric oxide ions are important SWIR emitters in the disturbed ionosphere. The proposed measurements will lead to improved ability to predict the expected SWIR emission intensities.

Laboratory measurements of vibrationally excited nitric oxide ions are undertaken in order to determine the rate of transfer of vibrational energy to molecular nitrogen and molecular oxygen. Relative photoionization cross sections will also be measured for the 0 through 4 vibrational level of the ion. If possible, the relative recombination coefficient will be measured for ions in levels 1 through 4. Two new items are being added to the approach. First, f-numbers for nitric oxide ions as measured on subject contract will be used to reanalyze previous U.S. Nuclear test data in the IR. Secondly, IR absorption data concerning UO and its ion will be measured with the use of a commercially available infrared tunable diode laser whose output is passed through a white cell integrated with the flow reactor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0012, AURORAL OVAL AND IONOSPHERIC SUBSTORM MONITORING

J. BUCHAU, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF247840)

AF function - ionospheric monitoring in support of communications, radar, and navigation systems. Deficiency - acquisition costs of geophysical data from remote, arctic locations are high, limiting amount and quality of data available. Delays in reporting auroral and geomagnetic disturbances have to be avoided for real time support of AF Global Weather Central and future OTH systems. Objective - development of techniques for the transmission and display of real-time high-latitude ionospheric and other geophysical data at Air Force user locations in forms useful for monitoring the auroral and ionospheric substorms. How research contributes - makes high-latitude ionospheric and geophysical

data, needed for planned ionospheric models, available at AF system user sites.

A prototype geomonitor display system will be procured for reception, processing, and display of ionospheric and geophysical parameters used to monitor spatial and temporal variations of the high-latitude ionosphere. The development of the geomonitor display systems builds upon an existing program in which the geomonitor system is being developed to compress ionospheric data and combine the ionospheric data with geophysical data for transmission to AF system user locations. The combined geomonitor and geomonitor display system will provide a capability for remote, automatic, real-time monitoring of the high-latitude ionosphere by AF user systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0013, IMAGERY INFORMATION EXTRACTION

J.J. BUNTING, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249520)

AF function - weather observing, analysis and forecasting military operations. Deficiency - lack of adequate information to meet military weather support requirements. Objective - development of improved techniques to facilitate real-time processing of satellite imagery. How development contributes - makes possible the real-time use of high-resolution satellite imagery in operational analysis and forecasting.

Develop a prototype cloud analyzing system based only on satellite data. Test this system and compare it with the results of the current operational system. Evaluate the results and if indicated work to expand and refine the system. This is a continuation of the work formerly performed under IHWU 66980205 which was terminated for administrative reasons.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0014, INDIRECT PROBING TECHNIQUES AND INSTRUMENTATION

K.M. GLOVER, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF240400)

Air Force function - navigation and detection functions of the strategic, tactical, air defense, and airlift forces. Deficiency - performance of these functions is reduced by lack of effective meteorological support, one contributing factor being the inability to process and display meteorological information from radars. Objective -the development of techniques and instrumentation necessary to enable the quantitative mapping of reflectivity, wind, and turbulence structure of a wide variety of precipitation structures. How development contributes - overcomes deficiencies in utilizing the capabilities of microwave radars to improve the required observation and prediction techniques.

Instrumentation which generates outputs of radar reflectivity, mean Doppler velocity, and variance along with recording systems will be used to establish, for a wide variety of meteorological structures, a data base suitable for non-real time development of computerized storm hazard identification and prediction techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0015, TRACKING SYSTEMS

J.R. GRIFFIN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF255130)

AF function - research vehicle tracking. Deficiency or opportunity - tracking systems used at remote operational areas require more effective capabilities in initial acquisition of a rocket during launch, or in reacquiring track after loss of signal lock. More reliable tracking is required for trajectory determining application. Techniques for tracking a target rocket from a second vehicle in flight with a ground-based S-band tracking antenna using predicted trajectory data. Develop a system for tracking a rocket vehicle from another airborne vehicle. How research contributes - techniques and instrumentation systems developed will provide a capability for computer programming of a ground-based telemetering tracking antenna. An improved tracking capability will enable more effective reception of telemetry signals from rockets launched at remote sites. The tracking system will be compatible with a PCM ranging system which was recently developed to provide trajectory information at remote locations and provide a technique for tracking a target rocket vehicle from another rocket-borne system in support of a specific AF project (task III).

The approach to this work will include use of a mini-computer that will control an S-band tracking receiver system. The system will utilize predicted trajectories to assist in obtaining initial acquisition of the target vehicle, which may be either a rocket or a satellite, and the system will be able to reacquire the track of a vehicle after signal has been lost. When coupled with a PCM ranging system, this telemetry tracker will be able to provide highly accurate trajectory information from a vehicle in flight. The system developed to track an airborne target from a second airborne vehicle will consist of a miniature airborne phase detecting r.f. tracking system. This will be designed to provide control of the rocket vehicle carrying the in-flight tracking system. Special techniques will be used to provide a wide angle of view for obtaining the initial tracking acquisition and then a narrow angle of view to provide higher accuracy while tracking the target vehicle.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, AURORAL OVAL AND IONOSPHERIC SUBSTORM MONITORING

W. HALL, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF244710)

AF function - communications, surveillance and navigation at high latitudes. Deficiency - knowledge of the effects of auroral oval and ionospheric substorm disturbances on communications, surveillance and navigation systems is inadequate. Ionospheric and auroral models predicting the effects of disturbances on these systems are marginal and need to be improved. Objective - to achieve automatic, remote, real-time monitoring of the auroral oval and ionospheric substorms. How research contributes - will provide capability to remotely display time-history and real time observations of various geophysical and ionospheric parameters. Will lead into automation of data acquisition from remote observatories into AFGWC. Will result in improved and cost saving operation of remote sensors and improve communications and operation of navigation and surveillance systems in high-latitude environment.

A geomonitor system will process ionospheric and geophysical data in real time at a remote observing location for transfer to a using location. Significant information is extracted from digital ionosonde data, reducing the data volume by 90 percent. Geophysical data from magnetometers, riometers, and radio polarimeters is digitized, summarized and formatted for transmission. A geomonitor display system (GDS) at the user site will receive the data messages transmitted by a data link. The GDS will reformat the messages, provide hard copy displays of significant characteristics and test the data for disturbances. Operational techniques for real-time interpretation and use of the displays will be developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, ULTRAVIOLET SURVEILLANCE BACKGROUND MEASUREMENTS

R.E. HUFFMAN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF244010)

AF function - target detection, surveillance attack assessment, tracking, communications. Deficiency - insufficient information concerning the spatial and spectral variability and magnitude of the global vacuum ultraviolet (VUV) radiation background. Objective -measurement with satellite sensors of the intensity of the VUV background, its spatial and spectral variation, and its correlation with ionospheric, solar, aeronomic, and auroral parameters. How research contributes - the background radiation from the earth's atmosphere must be known in detail for use with missile target intensities in the design and evaluation of new surveillance systems capabilities and for selecting optimum

wavelength bands. Improvement in communications system operation will be possible following validation of indicated correlations of VUV radiation with ionospheric critical frequencies and auroral zone locations.

The global VUV radiation levels will be measured with the satellite experiment CRL-246 vacuum ultraviolet backgrounds. A spectrometer will provide resolution in the range 1050 - 3100 Angstroms, and a photometer will provide spatial resolution comparable to systems resolution. An attempt will be made to observe cooperative missile launches as well, utilizing atmospheric limb scanning.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0018, TACTICAL STRATUS DISPERSAL

B.A. KUNKEL, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249190)

AF function - navigation, weapons delivery, command and control. Deficiency or opportunity - lack of capability to disperse stratus clouds that interfere with tactical Air Force functions. Objective - to develop operational stratus dispersal techniques for use by tactical Air Force aircraft, primarily in Europe. How development contributes -development will lead to the removal of stratiform clouds as constraints on Air Force operations.

Results of field tests, theoretical studies, and stratus climatologies will be used to develop operational supercooled stratus dispersal techniques, with special emphasis on targeting clearings over previously specified ground locations in central Europe.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, REACTION RATE APPLICATIONS

E. MURAD, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF248980)

AF function - communications and detection. Deficiency - inadequate knowledge of rate constants for molecular reactions and the negative ion formation for calculations of properties of disturbed atmospheres. Objective - evaluate rate constants and kinetic data of species important in disturbed and normal atmosphere. Tabulate rate constants and bond dissociation energies of relevant species. Measure cross sections for collisional dissociation of negative ions and for ion-neutral reactions. How research contributes - a knowledge of accurate rate constants makes it possible to predict ion, electron, and excited species concentrations using computer codes. This information can then be used to predict radio, radar, and optical blackout effects in a nuclear or naturally disturbed environment.

Published kinetic data will be evaluated and analyzed as to their reliability. Rates constants and bond dissociation energies for reactions important in the upper atmosphere under disturbed and normal conditions will be tabulated. Cross sections for collisional dissociation of hydrated negative ions and for positive ion-neutral reactions will be studied using double mass spectrometer systems adapted for use in the time-of-flight mode.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, PREDICTION OF PLANETARY BOUNDARY LAYER

C. YANG, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249330)

AF function - military operations involving Air Force vehicles used by strategic, tactical and general-purpose forces. Deficiency - such operations are adversely affected by deficiencies in predicting winds, weather, and other meteorological parameters in the planetary boundary layer. Objective - to evaluate the performance of the Global Weather Central's boundary layer prediction model in its on-line operation. How research contributes - this research will result in improved boundary layer prediction as well as improved understanding of boundary layer phenomena and will directly contribute to the operational capability of the Air Weather Service in severe storm forecasting and terminal weather forecasting.

The approach consists of an evaluation of the performance of the AFGWC operational boundary layer model followed by a variety of numerical experiments with the goal of improving both the efficiency and accuracy of the forecasts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, DESIGN OF AEROSPACE EXPERIMENTAL INSTRUMENTS

M.J. DAVIN, Wentworth Institute, Undergraduate School, *Boston, Massachusetts* 02115 (DF242320; F19628-74-C-0014)

AF function - military operations of the B-1, F-15 and other AF vehciles in the stratosphere, nuclear weapons delivery, communications, detection, track, and intercept. Deficiency - environmental effects of AF stratospheric operations cannot be predicted because of a lack of stratospheric data. Further, mixing and chemical effects of jet engine or missile effluents are only poorly defined. Inability to forecast upper atmosphere interactions affecting the design and operation of military systems such as reentry vehicles, over-the-horizon radar, polar communications and satellite ephemerides. Research - to increase ability to forecast atmospheric variables requires assessment models useful for AF stratospheric standards and criteria require composition analysis of gases collected periodically from the stratosphere. How research contributes - provide instruments for measuring composition and densities of neutral and ionized species and hardware to collect and analyze stratospheric gas species. Research, development, and test of components and assemblies are undertaken to create reliable operating hardware for rocket and balloon experiments.

Aerospace experimental instruments, components and ground support equipment are provided employing the following procedure - engineering liaison, research and design, design approval, fabrication, test, analyze, rework if necessary.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, NEPHANALYSIS MODEL TEST

R.M. PICKETT, Bolt Beranek & Newman Inc., *Cambridge, Massachusetts* 02138 (DF249090; F19628-77-C-0164)

AF function - DMSP imagery techniques for real-time processing. Deficiency or opportunity - inadequate techniques for the automatic extraction of information from DMSP satellite imagery. Objective -develop a nephanalysis model for use in the AFGWC 3-d analysis which is based solely on satellite data and compare and evaluate the results with the present operational model. How development contributes - decreases the GWC's dependence on data sources that might become unavailable or be denied in the future.

Develop and test a set of algorithms for selected cloud characteristics based only on satellite data and utilizing spectral analysis features based on fast Fourier transforms as primary algorithms. The resulting model will be tested against the current operational model, evaluated and recommendations for future work will be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, ANALYSIS OF SATELLITE SENSOR DATA

D.E. DELOREY, Boston College, Graduate School, *Chestnut Hill, Massachusetts* 02167 (DF275460; F19628-76-C-0190)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density and composition variations with time and space cannot be accurately predicted. Research - direct density and composition measurements with solar and geophysical parameters. How research contributes - permits development of accurate models to be used in forecasting techniques. Mathematical techniques and computer routines are developed to process satellite attitude and sensor data to calculate parameters to provide increased knowledge of atmospheric properties.

Develop and implement computer routines and techniques for the continued reduction of raw digital data from sensor outputs to vehicle attitude, sensor position vectors and associated ionospheric parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, PRECISE SATELLITE ORBIT DETERMINATION AND PREDICTION
J.M. FORBES, Boston College, Graduate School, *Chestnut Hill, Massachusetts* 02167 (DF246720; F19628-76-C-0059)

AF function - airborne surveillance, ballistic nuclear weapon delivery. Deficiency - vehicle ephemeris cannot be predicted accurately due to atmospheric and geopotential model inadequacies. Research -computations of atmospheric density for development and testing of advanced atmospheric and geopotential models. How research contributes -improves ability to determine satellite position as a function of time.

Develop more accurate methods of obtaining atmospheric density from radar observations of artificial satellites, to improve atmospheric model development using data from instrumented satellites, and to improve existing programs for predicting satellite orbits. Density results obtained from sensors on recent satellites will be combined with data from numerical integration programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, SATELLITE DATA PROCESSING AND ANALYSIS
R.W. FIORETTI, R D P Incorporated, *Waltham, Massachusetts* (DF247630; F19628-76-C-0244)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density variations with time and space cannot be accurately predicted. Research - direct density measurements with satellite-borne accelerometers. Results are correlated with solar-geophysical parameters and other experiments. How research contributes -permits accurate determination of Air Force satellite ephemerides.

A seta accelerometer is to be flown on Air Force satellites. This instrument permits high-accuracy, high-resolution atmospheric density measurements. Telemetry data from all the experiments will be provided on tape. The raw seta data will consist mainly of drag accelerations which are proportional to density and accelerations due to vehicle motions caused by thrusting. Digital filtering methods are used to determine those accelerations due to drag. Density is calculated directly from the drag data. These results are used to accurately determine the orbit of the satellite. In addition the density results are used for developing accurate atmospheric models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, AIRBORNE MARINE FOG STUDY
R. MARKSON, Airborne Research Associates, *Weston, Massachusetts* 02193 (DN590178; N00019-76-C-0588)

To study micrometeorological processes associated with the life cycle of marine fog. The knowledge and insights acquired will be applied to the development of improved fog forecasting and fog dissipation techniques.

A specially instrumented small aircraft will be used to make observations in and above ocean fog in coordination with the R/V acania. From these observations convective movement in the ocean boundary layer will be derived for correlation with other fog phenomena.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

5.0027, GAS-SURFACE INTERACTIONS IN CRYOGENIC WHOLE AIR SAMPLING
J.M. CALO, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (DF248590; F19628-77-C-0071)

To conduct experimental and theoretical investigations of the physico-chemical problems involved in collecting, storing, manipulating, transferring and analyzing whole air samples by cryogenic techniques. This work is intended to complement, and to be in direct support of, the stratospheric composition work unit of the stratospheric environment program at AFGL.

A vacuum chamber/gas sampling system employing mass spectrometry for diagnostics will be designed and constructed. Gas samples, chosen for their applicability to stratospheric composition studies, will be introduced to the system and chemical conversions and sticking and flaking on cryogenic surfaces of different materials will be investigated. Also, the effects of sampling rates and modes as well as sample warmup will be studied. NO to NO sub X conversion and determination of sticking coefficients for freons 11 and 12 on cryogenics surfaces will receive special attention.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, RESEARCH IN IONOSPHERIC PHYSICS
J.D. MATHEWS, Case Western Reserve Univ., School of Engineering, *Cleveland, Ohio* 44106 (ATM77-19645)

This grant funds a research program investigating the 40-100 km altitude region and the D region, in particular involving extensive use of the incoherent scatter radar at Arecibo, Puerto Rico, as well as extensive and related theoretical work to be performed at Case Western Reser ve University (CWRU). Winds, temperature, ion neutral collision frequency and electron concentration will be measured and an effort will be made to extend the instrumented capability to add negative ion concentration measurements. Tidal phenomena and metallic ion dynamics and chemistry will be investigated theoretically. In a major cooperative effort with the French meteor radar group and the Arecibo Observatory, the CWRU group is proposing to run the incoherent scatter radar simultaneously with the meteor radar for more than eight days of telescope time in late 1977 and early 1978. This effort would mean extensive new data as well as direct comparison of the two techniques for measurements in the 80-100 km altitude region. The observing program at the Arecibo Observatory will rely in large part on the efforts of a postdoctoral fellow in residence at the Observatory.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0029, SEAREX - SEA AIR TRANSPORT - ANTHROPOGENIC ORGANIC COMPOUND SOURCES AND FLUXES IN THE OCEAN
C.S. GIAM, Texas A & M University System, School of Science, *College Station, Texas* 77843 (OCE77-12482)

SEAREX is a multi-disciplinary, team-managed project aimed at understanding material transport between the atmosphere and sea surface of the major oceans. Particulate matter in air is trapped in tower-mounted collectors on two mid-Pacific islands near the equator. Material leaving the sea surface as bubble-induced spray and by evaporation is also collected. Analysis of this material for stable metals, radiochemicals, and organic matter is combined with measurements of accumulation rates to assess fluxes of major classes of pollutants. Results of this study will provide some of the basis for global models describing how pollutants interact with the oceans.

This award supports flux measurements of anthropogenic organic pollutants to the ocean, the use of specific organic pollutants to characterize the source of atmospheric compounds, and the examination of primary air-sea exchange mechanisms for these organic materials. Samples are collected from air, rain, dryfall, and surface seawater for analysis by solvent extraction and gas chromatography. The results of this study will provide important information on the fluxes and sources of anthropogenic organics.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0030, DYNAMICS OF THE HIGH-LATITUDE IONOSPHERE
W.J. RAITT, Utah Higher Education System, Graduate School, *Logan, Utah* 84321 (DF248300; F19628-77-C-0011)

AF function - surveillance, communication navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of plasma flows, charge distributions, electric fields

for the design needs of AF systems. Objective - study high-latitude ionospheric dynamics in three areas: 1. High-latitude F region dynamics, 2. Convection electrodynamics, and 3. Polar wind. How research contributes - provides data essential to HF and UHF propagation predictions, provides data required for the design and utilization of communication guidance and surveillance systems and provides understanding of the dynamical processes in the ionosphere.

Develop theoretical procedures and computer codes to determine plasma flow, particle distributions and effects of electric fields on the high-latitude F region. Satellite data will be utilized to test the theoretical methods and to develop a prediction capability for the high-latitude ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, CONJUGATE X-RAY AND ELECTRIC FIELD MEASUREMENTS AT ROBERVAL, CANADA

G.K. PARKS, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (DPP77-21203)

Four balloon payloads with detectors for measuring electric fields and X-rays will be launched from Roberval, Canada, in January 1979. The data obtained will provide information on magnetospheric convection electric fields and electron precipitation phenomena in the neighborhood of the plasmapause. The balloon flights will be conducted in conjunction with similar balloon experiments and rocket experiments at Siple Station, Antarctica, the magnetic conjugate point of Roberval in the Southern hemisphere. Comparison of the northern and southern hemisphere measurements will provide information concerning the conjugate characteristics of magnetospheric electric fields and electron precipitation.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, AREA OF INTERESTS/FIELD OF VIEW RESEARCH USING ASPT

W.D. LEMASTER, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223410)

To provide behavioral research data on helmet-slaved and target-slaved area of interest (AOI) visual displays within a wide-angle field of view (FOV). This study will serve as a basis from which to pursue flying training research on a cig visually coupled system (VCS) incorporated in the helmet device.

Phase I will determine the effect of various FOV sizes on gunnery range weapons delivery and establish minimum acceptable head-slaved FOV visual angle. Phase II will determine interaction between FOV size and head-slaved AOI detail level in tactical weapons delivery. Subsequent phases will establish the flying training benefits of the device in the areas contact airwork and tactical weapons delivery.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, DEVELOPMENT AND EVALUATION OF SIMPLIFIED INSTRUCTIONS FOR THE ACQUISITION OF THE NORMAL LANDING SKILLS

E.L. MARTIN, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF222030)

1. To develop instructional syllabi for application to simulator training of the normal landing. 2. To evaluate the effects of simplified instruction of the normal landing on the acquisition of landing performance by UPT student pilots. 3. To assess the contribution of various advanced training provisions. 4. To evaluate instructional effectiveness from the operator console.

UPT student pilots will be trained in ASUPT on the normal overhead landing order one of four conditions: (1) an adapted standard ATC procedure, (2) an incremental addition of control of ground track, configuration and airspeed, and altitude, (3) a segmentation of the pattern into four parts taught in order, and (4) segments taught in reverse order. In addition, half of the students will be taught with the instructor in the cockpit while the other half will be taught with the instructor at a remote console. The effects of the training conditions will be evaluated by learning efficiency in ASUPT and transfer to the aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, TRANSFER EFFECTIVENESS OF SIMULATOR MOTION AND SIMULATED IFS FIELD OF VIEW

M. NATAUPSKY, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223030)

To compare the levels of skill acquisition and training transfer for selected basic and instrument flight maneuvers as a function of platform motion (full versus no motion) and field of view (full vs. simulated IFS) using ASUPT.

The research will be conducted in two phases. In phase I each group of four UPT students will receive ASUPT training under one set of conditions on selected contract flying maneuvers including takeoffs, straight-in and pattern landings. The four conditions are: 1. Full platform motion and full (ASUPT) field of view, 2. Full platform motion and restricted (ATC/IFS) field of view, 3. No platform motion and full field of view, and 4. No platform motion and restricted field of view. Performance in ASUPT will be measured via the ASUPT automated performance measurement system and IP ratings. Transfer will be measured by IP rating on an expanded 12 point scale. Phase II of the research will emphasize instrument flying skills including GCAS. The same students used in phase I will receive additional ASUPT training. The procedure in phase II will be similar to phase I except half the subjects receiving the no-motion and half receiving the full platform motion in phase I will receive the full platform motion treatment in phase II. The remaining subjects will receive the no-motion treatment in this phase.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, RULE LEARNING AND SYSTEMATIC INSTRUCTION IN PILOT TRAINING

V.S. GERLACH, Arizona State University, School of Education, *Tempe, Arizona* 85281 (DF041950; AF-AFOSR-2900-76)

AF function - the Air Force conducts an extensive and costly undergraduate flying training program. Deficiency - the Air Force is restructuring its flying training programs to accommodate the substitution of simulator time for blocks of instruction previously carried out in airborne flight training vehicles. There is no available instructional technology to guide this transition. Objective - the goal of this research is improved strategies and instructional methods for undergraduate pilot training. How research contributes - this research will provide improved instructional methods for use by pilot instructors involved in the use of simulation, ground instruction, and instructions using the T-37 aircraft.

The following will be studied: rule learning as a prelude to the acquisition of complex psychomotor skills, internalization of a response repertoire, and the acquisition of chained sequences of behavior that characterize the proficient aircraft operator.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0005, INVESTIGATIONS OF TRAINING METHODS AND INSTRUCTIONAL TECHNOLOGY FOR AF FLYING TRAINING

H.E. SULLIVAN, Arizona State University, Graduate School, *Tempe, Arizona* 85281 (DF221820; F41609-75-C-0028)

To provide a basic research base for studies in instructional technology and to conduct status studies of the current roles of instructor pilots and student pilots.

Arizona State University will be placed under contract to perform studies as detailed in task orders. This approach will permit the exploitation of the research resources of the entire university rather than being confined to a particular department. Areas

to be investigated are pre-instructional strategies, cognitive pre-training, student stress, multi-media/programmed instruction, and instructor pilot roles for specified flying tasks.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0006, DETERMINATION OF PHYSIOLOGICAL RESPONSES OF PARACHUTISTS TO THE AEROSPACE RECOVERY ENVIRONMENT
D.W. CALL, U.S. Navy, Natl. Parachute Test Range, *El Centro, California* 92243 (DN032001)

To acquire physiological and force data from parachutists continously throughout parachuting operations; to correlate biomedical and engineering parameters; to use present technology to solve specific fleet problems with personnel recovery systems; to support the scientific design, development and testing of future life support systems to enable better human engineering; to investigate basic human response to dynamic environments.

Parachutist-borne multi-channel FM/FM telemetry systems are primary data acquisition systems and have been described. Single-channel tape recorder ECG units and backup and for Salton Sea and cockpit use. Parameters measured include: ECG (rate and rhythm), respiratory rate, riser forces, triaxial accelerations, EOG event marker, body temperature, and voice.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Medical Research & Development Command

6.0007, EFFECTS OF AIR FORCE POLLUTANTS ON VERTEBRATE CELLS IN VITRO
M.W. BERNS, Univ. of California, School of Biological Sciences, *Irvine, California* 92664 (DF046230; AF-AFOSR-3136-77)

AF function - the Air Force uses many unique chemicals and materials to obtain optimum performance for its aircraft and missiles. These chemicals and materials or their byproducts impact on the surrounding environment with varying degrees of severity on both a short-and long-term basis. Legislative and regulatory controls mandate that the Air Force is responsible for assessing and controlling pollution in its operations. Deficiency - rapid and accurate test systems are needed. A system is required that permits extropolation to the real-world situation. Objective - the purpose of this research is to develop in vitro an assay system for the evaluation of various environmental pollutants while obtaining a basic understanding of some of the mechanisms of agent action at the cellular level. How research contributes - the research directly supports subarea 1.5 'toxic hazards' and 1.9 'environmental quality'. Results could lead to controlled usage of known harmful agents and development of agents that have the same operational efficiency but with minimal biological effects.

Vertebrate cells in culture will be exposed to various agents and assayed for growth effects, chromosome effects, ultrastructural alterations and changes in cell behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0008, LONGITUDINAL CARDIOVASCULAR FITNESS IN USAFA CADETS
P.R. ELLIOTT, U.S. Air Force, *Colorado Springs, Colorado* (DF281870)

To measure the longitudinal cardiovascular fitness of USAFA cadets. This is a small part of the research program supported by AFOSR/NL at UC Davis.

Cadets (40) from the class of 1979 will be tested for metabolic rate during July and August of 1975 and follow-on testing in May 7 . Initial testing will be accomplished by a team consisting of USAFA and UC Davis personnel. Follow-on testing will be the responsibility of USAFA personnel. Funded by AFOSR-PO-76-0003.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

6.0009, IMPROVED CIG EDGE UTILIZATION STUDY
M. BUNKER, General Electric Company, *Daytona Beach, Florida* 32015 (DF228120; F33615-77-C-0033)

To develop new algorithms which will improve edge utilization in wide field-of-view (FOV) cig visual simulation systems. In current wide FOV cig systems, the edges are distributed over a large viewing angle, resulting in poor image detail. The poor image detail, in turn, reduces the training effectiveness of the system. This study will develop algorithms which will concentrate the cig edges into the primary pilot viewing areas. The pilot will be provided more and better visual cues without additional edges being processed by the cig system. This improved utilization of edges will increase the training cost effectiveness of future cig systems.

To analyze and develop two algorithms which will improve edge utilization of future cig systems. These algorithms are for (1) new level-of-detail (LOD) change criteria and (2) a real-time, dynamic area-of-interest (AOI) image over a background scene. In current systems, the LOD change criterion is based upon Nadir range. However, altitude, attitude and slant range are additional parameters which could be used to improve and increase the utility of the LOD algorithm. In the LOD algorithm to be developed, the above examples and other parameters are to be analyzed for use as new LOD change criteria. With this new LOD algorithm, the edges will be concentrated in the pilot's primary viewing area. In large FOV visual simulation systems, the pilot uses only a small, highly detailed FOV, termed AOI, at one time. If this AOI is constantly slewed to the pilot's look angle, the pilot will always view a highly detailed AOI image with a low detailed peripheral image. An algorithm will be developed which provides this dynamic detailed AOI without additional edges being processed by the cig system. The algorithm will be used for generating the AOI but does not include methods of directing the AOI. Methods of detecting helmet position are being developed by AMRL and other organizations. This work will be drawn upon for determining the position of the pilot's eyes for directing the location of the AOI.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0010, PHYSIOLOGICAL EFFECTS OF SHIP MOTION ON CREW MEMBERS
C.L. EWING, U.S. Navy, Aerospace Medical Res. Lab., *New Orleans, Louisiana* 70129 (DN141828)

To determine the effects of ship motion on crew members and casualties in shock, as induced by high-speed vessels and/or aircraft.

Measured vibration of the SES 100B and other vehicles will be reproduced in the laboratory and then used to stimulate both instrumented human volunteers and large primate subjects on whom physiological and pathological effects will be measured. The data are necessary in the development of medical evacuation capability using such vehicles and in determining effects of the specific vehicular motion on casualties and crew alike. The tolerance of the human being and primate analog to various durations and intensities of the measured motion will be determined in various postural modes and with various items of equipment.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab.

6.0011, MODELLING THE EFFECTS OF ENVIRONMENTAL STRESS ON HUMAN CONTROL AND INFORMATION PROCESSING
W.H. LEVISON, Bolt Beranek & Newman Inc., *Cambridge, Massachusetts* 02138 (DF040640; F44620-75-C-0060)

AF function - in the operation of high-performance aircraft and other special duty missions, crewmembers are exposed to a number of environmental stresses singly and in combination. The effects of stress on human psychomotor performance are not consistent, moderate stress may enhance performance on certain tasks. On the other hand, high-stress conditions usually degrade performance on tasks requiring a large share of operator information processing capability. Deficiency - the effect that a particular stress has on system performance depends largely on the parameter of the control situation and on the capabilities of the operator. A model of the task situation is desired which will allow predic-

tion of various stressors, singly and in combination, on performance. Objective - model and interpret the results from a series of experiments that explore two-axis tracking in a motion environment. How contributes - the research proposal will be of value to AMD programs and supports needs identified under RO 1.4, 1.5, and 1.6 and complements other AFOSR supported research in these objectives.

Two potential avenues of research are suggested -- (1) a study of two-axis tracking in a motion environment, and (2) measurement of effective thresholds relevant to the use of motion cues in steady-state tracking. The selection of a specific study area will depend upon progress made during the current phase and the suitability of motion simulators available to this effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0012, SIMULATION SOFTWARE FOR HUMAN ENGINEERING SYSTEM ANALYSIS AND EFFECTIVENESS EVALUATION

G. SABASKY, Internat. Bus. Machines Corp., *Owego, New York* 13827 (DF319350; F33615-75-C-5152)

The objective of this effort is to provide efficient software development to assure maximum utilization of the human engineering systems simulator (HESS). HESS is a computer-based facility with which weapon system concepts and design parameters may be tested and evaluated in real-time, dynamic, interactive, simulated contexts. Software developed under this contract will support a broad range of simulation and research programs in which alternative methods of allocating man-machine functions within complex Air Force systems are investigated in order to identify optimum techniques of control, display and processing of system information. The programs will involve both real-time man-in-the-loop simulations and computer-programmed system models or 'pseudo-time' simulations. Efforts supported by the program include performance assessment in dynamic flight simulations and assessment of advanced control/display concepts supportive of the digital avionics information system advanced development program, command-control-communications for remotely piloted vehicles for the Air Force's Drone System Program Office, and crew station design development for Strategic Air Command radar/navigation/electronic warfare functions.

Systems analyses will be accomplished as required to identify features essential to simulating systems for which human engineering data are required. Appropriate programming techniques will be identified and applied to permit efficient implementation of the system simulations on the HESS. Software modifications will be made as necessary to support developments in the associated research programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0013, APPLIED PHYSICAL ANTHROPOLOGY FOR DESIGN OF AF SYSTEMS

M. ALEXANDER, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF319190)

This work unit provides consultancy and guidance for the application of engineering anthropometric data in support of engineers and designers, and aids in the evaluation of the application of these data in end items and systems. Principal areas of work are related to the sizing and design of personal protective equipment for hazardous environments and the integration of the man (fully encumbered pilot) with his work station (cockpit).

Detailed anthropometric data form the basis for guidance in the design, sizing and procurement of clothing and personal protective equipment and for the design and layout of work spaces. These data to be effective must reflect the practical requirements of a design problem and/or end item. Each design task becomes a matter of reanalyzing the existing data, or developing new data as needed, to meet the specific requirements of a particular anthropometric design problem. This effort was formerly included under work unit 71840803, anthropometric design criteria for AF systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0014, REFINEMENT AND MODIFICATION OF VISUAL SYSTEM MODEL

M.W. CANNON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321540)

In order that the Air Force can properly assess the utility of various electrooptical display and image analysis systems, in use or contemplated, man-oriented system metrics must be developed. The objective of this work unit is to refine and modify the AMRL/BBM visual system model so that it will be able to make human performance predictions for a wider variety of inputs than is now possible. In particular, the upgrading of the model will be aimed toward developing a flexible evaluation tool for electrooptical systems by predicting human performance as tasks involving time-varying imagery with a wide dynamic range of light intensity.

The present static form recognition capability will be continually refined and upgraded to improve agreement between the model and experimental data. The model will be modified to include spatial frequency masking effects, flicker phenomenon and brightness computations. Model responses will be continually checked against experimental results from the literature, in-house and contractual efforts. Human performance criteria for certain visual recognition tasks will be derived from the model at appropriate points in its development.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0015, LIFE CYCLE COST OF SIMULATED VS ACTUAL AVIONICS MAINTENANCE EQUIPMENT FOR THE F-16 TRAINING PROGRAM

F.T. EGGEMEIER, U.S. Air Force, Human Resources Laboratory, *Dayton, Ohio* 45433 (DF228260)

To compare the life cycle cost of F-16 avionics intermediate-level training when conducted on simulated vs. actual aircraft and maintenance equipment. The results of the analysis will be a factor used by the F-16 System Program Office (SPO) to decide which type of training equipment to procure. The information provided by this study could also potentially impact on the cost and training effectiveness of other planned and existing systems. This analysis was requested by the F-16 SPO. The final product of this program will be a final life cycle cost report from the contractor to the F-16 SPO. No AFHRL TR is planned.

This program is being conducted in two phases. Phase I (Aug-Dec 76) was a general comparison of estimated life cycle costs for each type of equipment and was conducted in-house by AFHRL/AS. Phase I provided early estimates of the general configuration of the simulated equipment required to accomplish the training objectives and a general comparison of systems costs. Phase I results provided input for initial decisions about equipment procurements and were used to decide if a more detailed life cycle cost comparison was warranted. Since phase I supported the use of simulated equipment, phase II (Jan 77-July 78) is being conducted by AFHRL/AS with contractor support. Phase II is a detailed life cycle cost comparison which will be based on the more extensive training and test station engineering data which is scheduled to become available in the Jan 77-July 78 time frame. During Jan-Dec 77, data and information which become available will be assembled. The major life cycle cost effort has been scheduled for Jan-July 78.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0016, VCASS LABORATORY SYSTEMS DESIGN/INTEGRATION

T.A. FURNESS, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321150)

To perform the systems analysis and design of the overall visually-coupled airborne systems simulator (VCASS), including the visually-coupled systems (VCS) components (helmet-mounted sight/helmet-mounted display), scene/graphics generators, and crew station, computational, software data base subsystems. To specify the configuration of VCS and scene generation components to be developed on contract. To integrate these components into a laboratory systems demonstration of the VCASS concept. The ultimate product of this program will be an

extremely cost-effective, high-fidelity visual scene simulation capability to be utilized for engineering design as well as training applications. This effort supports AFSC development goals TC-2, TC-4, TC-5, MS-4, and TN-1.

The overall VCASS effort will exploit the unique capabilities of the visually-coupled system (helmet-mounted sight/display) technology in order to provide a self-contained ground/airborne man-in-the-loop visual display scene simulator for performing man-machine interface design and engineering of cockpit control/display subsystems. Initially, an interim laboratory demonstration capability will be developed by integrating existing helmet-mounted sight and display components into a cockpit mockup with an interface to a programmable symbol generator. A demonstration will then be performed to show the conceptual use of the VCS as a hemispherical headup display. Psychophysical studies will be conducted to determine the critical VCASS design factors such as the required instantaneous field-of-view of the helmet-mounted display, display update rate, angular resolution/update rate of the helmet-mounted sight and trade-off between monocular versus binocular display viewing. As a result of these findings, advanced VCS components will be specified and developed through separate contractual efforts. Simultaneously, a comprehensive systems analysis and system design will be performed for developing an advanced laboratory demonstration of the VCASS concept.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0017, PATHOLOGICAL MECHANISMS

A. HALL, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF315120)

To define the morphology and mechanisms of toxic injury at the cellular level.

To describe by light and electron microscopy and to document the pathologic change seen following toxic injury in experimental animals. To integrate these changes with clinical chemistry and hematological changes, and then ultimately, to correlate these changes with cellular biochemistry. To perform morphometry on tissues and cells at the microscopic level. To determine the efficacy of drugs used for treatment of intoxication by evaluation of change in animal tissues and blood. To perform quality control on animals used in toxicity studies employing hydrazines and haloalkanes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0018, OPERATOR HEAD/EYE CONTROL CHARACTERISTICS

J.P. HORNSETH, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321040)

The main thrust of this work unit will be to determine the conditions under which it is desirable to use the head or eye for manned and unmanned aircraft piloting, weapon delivery, and sensor control. The research effort will concentrate on determining the natural characteristics of hand, head, and eye tracking, including the effects of environmental stressors on these characteristics. An integral component of the research will be the effects on control performance of image format and location in the visual field of displayed feedback and secondary task information. The results will provide data required for the selection and specification of control-display systems proposed for operational applications. The research will also identify promising new techniques of harnessing the operator in control task situations and suggest further development or prototype application and evaluation.

Experimentation will be conducted in a fixed-base laboratory and in simulated flight environments incorporating vibration and gz stressors. When practical, data from complementary in-flight tests will be used to validate the ground-based results. Operator control performance with a hand controller, the helmet-mounted sight, and the oculometer will be investigated to establish a data base of operator pointing accuracies and frequency response which will document the performance trade offs for hand, head, and eye controllers. Concurrent experimentation on a vibration simulator will begin to quantify the effects of a buffetting environment on head control and seek to develop software techniques to compensate for errors induced by the head rotational system's vibration transmissivity. Experimentation to be conducted on the AMRL centrifuge will compare hand, head, and eye control performance under gz acceleration to determine the mode of response that is best for an operator to use in aiming the fire control system in a high-performance aircraft. Additional laboratory experimentation will explore natural head-eye coordination. The results will influence the design of the helmet-mounted sight reticle and the development of a helmet-mounted oculometer. This effort was previously reported under work unit 7184-04-43, control concept development.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0019, NOISE CONSULTATION AND RESEARCH FOR US EPA

D.L. JOHNSON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321270)

The EPA is directed by the Noise Control Act of 1972 to regulate noise in the United States to within exposure conditions that are safe and acceptable from a health and welfare standpoint. The objective of this effort is to provide noise effects research on problems of mutual EPA/USAF interest and also to provide consultation on the entire spectrum of noise exposure problems based upon the extensive AF noise experience over the past three decades. The research results will provide a technology base for use by EPA in the promulgation of their regulations and the technical noise expertise will provide analytical reviews, comments and recommendations regarding research proposals, programs and strategies considered for use by EPA.

The approach is for AMRL scientific and technical personnel to conduct and monitor research efforts of mutual AF/EPA interest in the safety and effectiveness of persons in noise environments. AMRL will also provide consultation by responding to specific requests to review EPA documents, practices and programs as well as those proposed and implemented by other agencies. Since a majority of these requests occur without prior notice and in a rather random fashion, it is impossible to project a schedule of events.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0020, BIODYNAMIC ENVIRONMENTS FOLLOWING CANOPY LOSS

W.F. KENDALL, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322350)

Due to the unique one-piece construction of the F-16 canopy, the pilot will be exposed to an unknown cockpit flow condition following canopy loss. However, the high degree of pilot acceptance makes this type of canopy a likely choice in future USAF aircraft. A definition of the cockpit flow conditions and their effect on the capability of the pilot to recover the aircraft is the objective of this work unit. This question is an open safety item of the F-16 and should be answered prior to full-scale production of the F-16 or any future aircraft with similar canopies.

A review of windblast literature and operational canopy loss data will be accomplished. AMRL will design and conduct a human test in the NASA ames 40 x 80 ft wind tunnel. To simulate the cockpit environment following canopy loss at lower speeds USAF pilots will be seated in an open F-16 forebody mounted in the tunnel. The subjects will perform a tracking task and a subjective evaluation of the environment up to 200 kts tunnel speed. Measurements of the cockpit flow conditions will be made. The factors limiting pilot control will be defined and quantified. The need for additional pilot protection will be determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0021, DETERMINE AIRBASE/COMMUNITY NOISE FROM AF AIRCRAFT/ENGINES OPERATING WITH GROUND RUNUP NOISE SUPPRESSORS

R.A. LEE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF323240)

Aircraft ground runups are one of the major sources of noise on-base and in surrounding communities. Many times aircraft runup noise suppressors are used to reduce the radiated energy. The Noisefile used in Noisemap presently includes only nominal design levels for such suppressors since adequate measured data as a function of angle around the source are not available. HQ USAF/PRE and majcoms clearly intend to use Noisemap as a tool for assessing the need for and potential effectiveness of such multi-million dollar suppressors in specific situations. The object of this work unit is to acquire the data needed to define the noise radiated by AF aircraft using standard runup noise suppressors in ways suitable for use by Noisemap and also for incorporation into the Noise Data Handbook.

Current plans are for four surveys to be conducted during the summer and fall of 1977 with tentative follow-up surveys the following measurement season. The four surveys in 1977 will acquire data on the A-7, F-4, F-5, F-15, F-100, F-106 and F-111 aircraft while operating in their demountable suppressors. The first survey will serve as a pilot study to determine the extent and kinds of measurements to be taken to adequately assess the noise environment with a minimum of measurements for the subsequent studies. These acoustic data will be analyzed, processed and incorporated into Noisefile/Noisemap, the community noise prediction procedure used under the USAF Air Installation Compatible Use Zone (AICUZ) program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0022, COMPUTER-AIDED HUMAN ENGINEERING DESIGN

J.W. MCDANIEL, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320930)

The objective of this work unit is to develop a computerized technique which will accomplish major elements of the design of man-machine crew stations. The products will be detailed, integrated design requirements to be utilized by those activities that procure crew stations and the capability to provide either crew-station design alternative or evaluation of existing designs. The work unit will also provide realistic modeling techniques for evaluating man's performance capabilities in hazardous environments in order to reduce the risks associated with experimenting with human subjects. This effort is coordinated with cognizant U.S. Navy and NASA personnel in regard to both overall objectives and technical approaches.

Computer-aided design and evaluation techniques will be developed which translate the human engineering data statistical bases into functional standards for crew-station design and evaluation. Computerized interactive graphics techniques will be employed to minimize the time required to (1) design crew stations and (2) analyze that or other designs. The Computerized Biomechanical Man-model (Combiman) program will display to the user a man-model of variable proportion capable of simulating the physical characteristics of crew members in a true 3-d crew station. During FY 77, the Combiman link and enfleshment equations will be validated against actual subject data including clothing and protective equipment variables. By the end of 1978, the model will be able to simulate the characteristics of AF women in the work place. The Human Engineering Computer-aided Design (HECAD) program will allow the user to perform complex task analyses on candidate control/display configurations. The times required to reach, operate, and attend to various types of controls/displays can be rapidly determined on an interactive graphic-type display. During 1977, human performance data on operation of standard cockpit components will be incorporated in HECAD.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0023, ACUTE FISH BIOASSAY

A.R. SLONIM, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320510)

To determine the water pollution potential of aircraft fuels and lubricants, missile propellants and their exhaust products, and other AF materials that if in sufficient quantity could result in significant detrimental effects on the environment. Transient physiological changes in organisms and toxic effects up to fish kills can serve as indices of potential pollution of the aquatic environment. The results of these studies will serve as a data base upon which environmental impact statements and assessments can be made as they apply to weapon systems using these chemicals especially where they may possibly enter an aquatic environment. The acute fish bioassay portion of previous work unit (AMRL-6302-04-11) was transferred to this work unit.

The approach to this effort utilizes experimental concepts developed in water pollution technology and fisheries biology. The applied conditions of these operational AF compounds and the types of test organisms to be utilized determine the methodology for experimentation. Propellant bioassays accomplished with guppies will be repeated using the fathead minnow currently and other fish species subsequently. The acute toxicity of hydrazine, UDMH, aerozine-50 and MMH, respectively, will be determined. Following the determination of acute toxic levels of these important compounds, the efficacy of various chemicals will be evaluated relative to reversing or reducing the toxicity to fish life.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0024, DEVELOP NOISEFILE 2 AND EXPAND/UPDATE NOISE DATA HANDBOOK TO DEFINE AIR-BASE/COMMUNITY NOISE

J.D. SPEAKMAN, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321400)

The AMRL noisefile (developed under work unit 72310425) contains the aircraft flight and ground runup noise data required as input to the Noisemap environmental noise exposure predictive program. The USAF Noise Data Handbook (developed under 72310418) includes the data needed by bioenvironmental and civil engineers for defining/resolving on-base and surrounding community noise problems from ground runup operations. It is essential that both Noisefile and the Noise Data Handbook be continuously expanded/updated to include data on aircraft currently in inventory as well as new systems as they are developed. This is critical for: (1) air staff/majcom/SPO beddown/deployment, environmental noise impact, and compatible land use studies using the Noisemap computerized procedure, and (2) airbase/majcom local facility siting and ground runup noise assessment studies using the Noise Data Handbook.

Instrumentation, test protocols, and data reduction techniques previously developed by amrl will be used to maintain continuity with the prior data acquired and analyzed on over 40 aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0025, SIMULATOR DEVELOPMENT

G.J. VALENTINO, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322530)

Design, development, and fabrication of the MTQ-1 ground-to-air simulator. Design analysis of gates, the ground-to-air tactical engagement simulator. Final in-house simulation capability will include optical electrooptical, and radar tracking as well as target aircraft video and optical generation, aircraft trajectory generation, weapon console, and data acquisition and analysis system. Special graphics, such as tracers, will be devleoped as needed. Computer control of all subsystems is required.

The MTO 1 simulator will be modular with the following subsystems (a) aircraft model, gimbal, and light tunnel, (b) main TV camera with range zoom lens, (c) intermediate monitor with deflectable raster and camera (an electrooptical scan converter) to present system tracking errors, (d) projection TV system to transmit final video to eyepiece, (e) a radar subsystem, (f) console with tracking controls, and (g) computer control system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0026, MAINTENANCE AND OPERATION IN SUPPORT OF RESEARCH ON VISUAL PERFORMANCE IN MULTIAX-

IS OSCILLATING INERTIAL FORCE ENVIRONMENTS (MOIFE)

G.T. COLLINS, Univ. of Dayton, Res. Inst., *Dayton, Ohio* 45409 (DF317930; F33615-76-C-0401)

Effects of chronic and acute exposure of humans to vibration stress are not sufficiently well understood to permit optimal weapon system design. The primary goal of this effort is continued safe operation of the branch's motion simulators in support of in-house research. Emphasis on in-house control of experiments with human subjects dictates that protocols and interpretation of reduced data be controlled by Air Force personnel. Additional research is therefore aimed at obtaining support in carrying out approved protocol, obtaining data, and improvement or modification of simulators to give special environmental simulation.

The contractor will (a) establish and/or maintain safe operational procedures for all branch motion simulators and power supplies in operational status, (b) provide continuing operational and engineering support for said simulators and power supplies, (c) provide research into special instrumentation required for experiments carried out on said simulators, (d) provide data collection, reduction and analysis support for experiments carried out on said simulators, (e) provide research required to modify said simulators, their power supplies or their control systems when special environmental simulation is foreseen, (f) provide orientation in operation and maintenance of branch motion simulators to otherwise qualified newly assigned in-house personnel.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0027, MEASUREMENTS IN THE LASER IRRADIATED EYE

A.J. WELCH, Univ. of Texas, School of Engineering, *Austin, Texas* 78712 (DF048650; AF-AFOSR-3314-77)

AF function - Air Force personnel may be exposed to a wide spectrum of radiation hazards in the operation of aircraft and weapon systems. This spectrum includes laser energy. The results of the measurements proposed should substantially contribute to work being conducted by USAFSAM in TPO II, radiation hazards. Deficiency - techniques are needed to develop microsensors which are capable of acquiring data in the pulse duration phase associated with most Air Force lasers. It seems probable that the development of these microsensors will add substantially to the attainment of means of direct measurement of temperatures during short-duration exposure of the eye and for small retinal images. In addition, the investigators will measure the transmission properties of the monkey eye by the use of a dye laser. Objective - this research will lead to intensity and electrical activity within the laser irradiated eye. In addition, measurements of the transmission properties of the eye will be accomplished with the use of a dye laser. How research contributes - the need for determination of safe retinal exposure levels to high-intensity visible light increases each year. The health hazards of these sources cannot be properly evaluated until we increase our knowledge of the nature of the damage mechanism and are better able to measure these effects. This research will afford the means to more accurately assess and quantify the effects of laser irradiation on the eye.

Measurements in the laser irradiated eye will be made by the insertion of newly developed fiber optic probes as well as from combination fiber optic - thermocouple probes and combination electrode - thermocouple probes. The probes will be inserted in monkey eyes. By scanning the animal through the laser beam, it should be possible to produce high-quality two-dimensional intensity profiles of the retina. Also simultaneous light - temperature recording or ERG - temperature recordings will be made using the rabbit and/or monkey.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0028, INVESTIGATION OF ADAPTIVE OBSERVERS FOR THE HUMAN OPERATOR IDENTIFICATION PROBLEM

B.K. COLBURN, Texas A & M University System, Graduate School, *College Station, Texas* 77843 (DF048260; AF-AFOSR-3295-77)

AF function - in the design of high-performance control systems, accurate models of the pilot dynamics are necessary to properly account for the pilot as a control element. Deficiency - pilot models can be used to perform stress tests which might be harmful or undesirable to subject humans to such as nuclear irradiation. hypoxia, severe acceleration due to extremes of aerial combat maneuvers, and responses due to temperature and vibration. Objective - the real-time identification problem as regards aircraft pilot modeling and parameter identification as currently under study by the USAF School of Aerospace Medicine will be examined. How research contributes - the research will enhance the development of on-line identification algorithms for identifying time-varying models, both linear and nonlinear. The resulting computer algorithms will be useful in obtaining accurate, reproducible pilot transfer function models which are of great importance in predicting accurate responses for human stress studies.

New identification approaches will be developed, and an investigation of the identification algorithms via computer simulation will be verified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0029, PROCEDURAL TESTS FOR ANTI-G PROTECTIVE DEVICES

R.W. THOMPSON, Technology Incorporated, *San Antonio, Texas* 78217 (DF320570; F33615-77-C-0610)

The purpose of this effort is to provide more definitive data on standard and experimental anti-g valve operational characteristics. In addition a failure analysis life expectancy of g valves will be undertaken. The final products will be (a) the development of a standard experimental technique for evaluating anti-g valves, (b) a standard analytical approach for evaluating g valves, (c) and a failure analysis/life expectancy prediction of a g valve.

The contractor will impose various onset rates of g and absolute g levels to g valves using the SAM centrifuge while also modifying flow rates of air and inlet pressures of air to the valve. Using these experimental techniques he will develop and test an anti-g valve test protocol for reliability and producibility as a standard test procedure. Also using this technique, he will test standard and experimental valves in various modes of failure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0030, TRACE METALS CORRELATIONS

E.L. ARNOLD, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321760)

The objective of this effort is to develop methods of trace metal analysis applicable to biological specimens, to apply trace metal analysis techniques on a routine basis to patients seen by the Aeromedical Consultation Service, to ascertain the association of changes in trace metal content in biological specimens with the presence or absence of cardiovascular and metabolic diseases, and to ascertain the usefulness of trace metal analyses as a predictive and diagnostic tool for the detection and/or prevention of cardiovascular and metabolic disease in the Air Force flying population.

Instrumentation will be gas and/or liquid chromatography and atomic absorption spectroscopy. Accuracy of all analytical methods must be verified by recovery studies and NBS standards, and the results checked by a separate, completely independent method. Precision must be at least 1/4 the normal range. All methods developed for trace metal analysis will document any sources of contaminating trace metals from the environment. Stability of samples analyzed will be documented across time. The chemical and instrumental interferences caused by competing elements must be documented. Chromium in biological fluids will be measured first. A simple method using atomic abosorption spectroscopy will be developed, as well as a chromium method using gas chromatography techniques. Work was formerly documented under 7755-05-08.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0031, CREW UTILIZATION/CREW RATIOS FOR ADVANCED STRATEGIC OPERATIONS

H.M. HUGHES, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322160)

The effect of aircrew management policies on operations is complex due to the many factors involved and the complex interactions of these factors. Optimum values of aircrew manning and scheduling can be evolved through a proper mix of field studies of actual operations and laboratory/computer simulation of anticipated conditions not yet experienced. Field studies provide the necessary data base for postulated airlift operational conditions, while computer simulations significantly reduce the time and expense of field study data collection. Efforts will pay primary attention to upgrades and advanced concepts of the jet transport fleet.

Computer simulation program, developed at USAFSAM, which focuses on the aircrew aspects of airlift operations, will be used to simulate operations of the upgraded/advanced jet transport fleet. Effects of upgrades and innovations on the required manning will be explored and analyzed. When necessary to establish a unique data base, field studies will be conducted of crew fatigue and stress as measured by the SAM stress battery. Previous effort documented under 7930-10-01.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0032, MAJCOMS AND BASE-LEVEL SUPPORT

D.H. SPOOR, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322000)

The objective of this work unit is to provide direct support to requestors for assistance through utilization of the existing aerospace medicine technology data base, the expertise of the Clinical Sciences Division staff, and where required, the expertise of USAFSAM resources outside of Clinical Sciences Division.

The approach to be utilized will involve initial Division staffing of the specific request to determine the full spectrum and scope of the endeavor, the individuals to participate in the evaluation and the assignment of OPR to a specific Clinical Sciences Division scientist. All available Division resources will be subject to utilization at one time or another including the various medical information files, the accumulated patient evaluation records from the Aeromedical Consultation Service, and also the accumulated years of aeromedical experience and judgment. Anticipated products will be summary of evaluations and analyses which may be in a simple letter reply, a USAFSAM technical report, or published paper. This is a new-start work unit for fiscal year 1977.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0033, HUMAN CAPABILITY VALIDATION OF ANCILLARY LIFE SUPPORT EQUIPMENT

R.L. STORK, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322660)

During the past four years, a close alliance has evolved between USAFSAM and the 412A life support SPO, based largely on the human compatibility evaluation of life support equipment. That work was previously done in work unit 7164-17-11, and due to a divisional restructuring, was transferred to this work unit. The goal of this work unit is to provide an independent Air Force judgment on the effectiveness of new aircraft equipment, and to identify problems associated with new concepts prior to the cost, risk, and visibility of a field OT&E.

Evaluation of criteria and human compatibility will be documented under this work unit; when data indicate a need for new or revised criteria, specifications, or technology, coordination/handoff to the relevant work unit will occur. Close coordination will be established and maintained with potential USAF customers such as 412A Life Support SPO and ASD. Evaluation requirements are usually short-term and will be partially or fully reimbursed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0034, GLAUCOMA

T.J. TREDICI, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF323020)

Glaucoma has long been recognized as an important cause of ophthalmologic morbidity and removal from flying status in USAF aircrew personnel. A concerted effort is made at base level to identify affected aircrew personnel early, based on elevated intraocular pressure. This is most practically performed by using the Schiotz tonometer. The use of this instrument is taught to all flight surgeons during their course of instruction at USAFSAM. Further, the use of tonometer as part of the base-level follow-up program is the most important part of the USAF policy on glaucoma. The objective of this work unit is to evaluate criteria for diagnosis, to delineate factors or characteristics which identify the point in the disease process when therapy should be instituted, to evaluate therapeutic modalities for both efficacy of treatment in absence of visual side effects which would contraindicate the performance of further flying duties, and where possible, to identify factors which causally relate progression of the disease.

The approach will involve careful and detailed ophthalmologic evaluation of each individual patient, with both follow-up interval and decision to commence therapy to be determined on an individual basis. The extensive and changing knowledge in literature in this field, both military and civilian sources, will be utilized as well as the accumulated expertise of the Ophthalmology Branch, Clinical Sciences Division, in follow-up and treatment of this disorder in aircrew personnel. The study will also include those patients with a diagnosis of glaucoma who are on therapy with epinephrine drops which is recognized as efficacious and accepted by the Surgeon General for chronic use while retaining flying status (AFR 160-12). Work under this unit was formerly conducted under 7755-09-05 and 7755-09-04.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0035, EFFECTS OF COMBINED STRESSES OF AF OPERATIONS AND MEDICATION ON CARDIOVASCULAR AND NERVOUS FUNCTIONS

A.H. BRIGGS, Univ. of Texas, School of Medicine, *San Antonio, Texas* 78284 (DF026870; AF-AFOSR-3029-76)

AF function - AF operations involve a wide range of aircraft and related weapons systems which may impose abnormal levels of stress on human operators due to extremes in temperature, pressure, acceleration, vibration and breathable atmospheres. The circulatory and nervous systems are early to be affected by such challenges and their responses are in many cases unknown as to time of onset and degree of application. Deficiency - there is a need for updated technology to protect the human operator from such environmental extremes and/or to extend operator tolerance and performance. Objective - this research seeks to develop an understanding of discrete basic mechanisms of circulatory and nervous system adaptation to stresses encountered in an AF operational environment. How research contributes - this research directly supports task 2312a3 and indirectly, other tasks in the life sciences technical area.

Five research efforts will be pursued which closely complement and support research and exploratory development efforts ongoing at USAFSAM and AMRL.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0036, WINDSHIELD QUALITY AND PILOT PERFORMANCE

C.L. KRAFT, Boeing Company, *Seattle, Washington* 98108 (DF320150; F33615-76-C-0516)

The research effort being procured is in direct support of (and is being funded by) the AFFDL Improved Windshield Protection Advanced Development Program Office (ADPO). The effort is an integral part of a joint AMRL/SAM program to investigate the visual factors associated with windscreens and the assessment of the effects of these factors on pilot performance. The specific objectives of this research are to measure the performance of aircraft pilots using windscreens of known optically distorted quality and to relate the performance to pilot vision measurements and to physical characteristics of the windscreen

panels. The ultimate objective is to establish design criteria and military specifications for windscreen quality.

The approach to be followed requires the extensive measurement of pilot (subject) vision characteristics, the utilization of a series of experimental windscreen panels of known, controlled distortion in an aircraft night landing simulator, and the measurement of pilot performance under different conditions of flight. The relationship between pilot performance and various measures of distortion will be determined. This will allow specifications to be formulated for minimally acceptable windshield quality for new aircraft and replacements in current aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0037, PERSONNEL TECHNOLOGY - EFFECTS OF LIFE STRESS AND COPING SKILLS ON PERFORMANCE AND ORGANIZATIONAL EFFECTIVENESS

I.G. SARASON, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (DN575416; N00014-75-C-0905)

In developing personnel who will later be exposed to high levels of stress (e.g., aviators, submariners, UDT personnel), the Navy and MarCorps are limited by gaps in our knowledge of the fundamental relationships among situational stressors, life stress, individuals' coping skills, and organizational effectiveness. This work unit is designed to clarify these relationships and experiment with various individual and organizational procedures for improving the ability to cope with stress in organizational contexts.

Earlier research has demonstrated that stress is associated with morbidity and with decreased performance in certain kinds of situations. This research is producing new measures designed to assess organizational stress. The investigator is experimenting with various techniques for altering cognitive responses since these are hypothesized to be involved in mediating the deleterious effects of stress on performance. The initial experiments in civilian groups exposed to high levels of job stress (e.g., firemen), will, if successful, be extended to certain military groups working under high-stress conditions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, NUMERICAL METHODS

E.B. SAFF, State University of Fla. Sys., School of Natural Sciences, *Tampa, Florida* 33620 (DF038880; AF-AFOSR-2688-74)

AF function - the design of chemical laser devices, the study of nuclear weapons effects on structures and aerospace vehicles. Opportunity - the use of Pade's approximants to develop computational algorithms for solving the stiff differential equations arising in the application areas listed above may provide useful tools to engineers and scientists in the Air Force laboratories. Objective - this research intends to investigate certain outstanding stability questions involving linear multistep methods generated by the subdiagonal Pade approximation of exp (-z). How work contributes - results from this research may lead to more effective and stable numerical algorithms for solving stiff differential equations.

This research will investigate the regions of absolute stability for linear multistep methods derived from the Pade approximation to exp (-z) and will determine if such method is a (alpha) - stable in the sense of Dalquist. Four specific mathematical questions which will throw light into the theory of pade's approximants of exp (-z) will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0002, NUMERICAL METHODS FOR TIME-DEPENDENT ASPECTS OF HIGH-SPEED AERODYNAMICS

S. ABARBANEL, Tel Aviv University, *Ramat Aviv, Tel Aviv, Israel* (DF044530; AF-AFOSR-3035-76)

AF function - aerospace vehicles. Opportunity - efficient numerical methods are well along for solving the compressible inviscid time-dependent Euler equations which govern the flow outside boundary layers. There is a need for efficient algorithms which take into account not only effects of the compressibility of the medium but of viscosity as well. The applications of such a development are immediately relevant to Air Force needs, for example, new generations of an air-to-air missile which will be highly maneuverable and will encounter high angles of attack even at high speeds. The aerodynamic characteristics of such slender blunted axisymmetric bodies are highly dependent on viscous phenomena. Complete numerical predictions of such configurations are beyond the current state-of-the-art. Objective - to improve the present state-of-the-art of numerical predictions of real flows through development of efficient algorithms (comparable to those previously developed for the time-dependent Euler equations which are hyperbolic) for parabolic partial differential equations such as the time-dependent Navier-Stokes equations. A promising step in this direction has already been taken under previous support of this effort. How work contributes -economics alone dictates that design for sustained high-speed flight must be reduced to an accurate engineering procedure. This is not now possible, especially in the case of highly accelerating bodies with non-horizontal flight trajectories in high-speed flight. Development of rapid and reliable methods of computing viscous compressible flows through resolution of the conceptual problems of concern to this effort will do much to bolster engineering confidence in numerical analysis, thereby giving the engineer an added and vital tool for use in efficiently and economically predicting complex flow field interactions.

For equal spatial meshes the number of time steps required for stable numerical solution is much larger for the viscous case than for potential flows. This effort is an attempt to develop explicit finite-difference algorithms for parabolic partial differential equations (the Navier-Stokes equations) that circumvent this difficulty by exploiting such concepts as a generalized Dufort-Frankel method.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0003, A STUDY OF WAVE AND BOUNDARY LAYER PHENOMENA IN FLUID SYSTEMS

H.P. GREENSPAN, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (DF047210; AF-AFOSR-3234-77)

AF function - aerospace vehicle design and operation. Opportunity - nonlinear fluid flow effects suggest new techniques for design and explain meteorological anomalies. Objective - an understanding of the implications of nonlinearities on drag, damping, turbulence, etc. How work contributes - by suggestive examples exhibiting and quantifying relevant nonintuitive effects.

The several approximations to the nonlinear partial differential equations of viscous fluid flow are treated analytically, by boundary layer techniques and numerically to obtain solutions to boundary value problems displaying effects like transition to turbulence, interactions between short and long waves, waves in stratified flows, waves on erodable boundaries, and in stability and separation in a rotating fluid.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, OPTIMIZATION OF STRUCTURES USING FORCE METHOD OF FINITE ELEMENT ANALYSIS

R.A. GELLATLY, Bell Aerospace Company, *Buffalo, New York* 14240 (DF139490; F33615-77-C-3032)

The use of automated design of structural components contributes significantly to the effectiveness and efficiency of flight vehicles. There is a need to develop a method to design an aerospace vehicle with specific strength and stiffness requirement. This will provide an analytical tool for minimum weight design of the structure thus improving the performance and cost of the aerospace vehicle.

The method will be based on the force method of finite-element analysis and the optimality criteria for a minimum weight structure. The use of force method will reduce the number of iterations needed in the design procedure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0005, THE STABILITY AND DYNAMICS OF ELASTIC STRUCTURES AND WAVE PROPAGATION
E.L. REISS, New York University, School of Arts & Sciences, *New York, New York* 10012 (DF044940; AF-AFOSR-3076-76)

AF function - to design stable aerospace structures. Opportunity -a new mathematical approach to buckling in the presence of imperfections and to secondary buckling. Objective - a safer, lighter, more efficient structure. How work contributes - original techniques for predicting catastrophic and secondary buckling and flutter.

Asymptotic techniques of stretching and matching yield nonsingular equations which extend bifurcation theory. This extended theory will be explored in the contexts of buckling with imperfections, secondary buckling, and nonlinear dynamic stability. Possible directions of research include extension of the theory to the more imperfection-sensitive bifurcation points of higher multiplicity, periodic and quasi-periodic fluid structure interaction such as aircraft panel flutter, a statistical theory of bifurcation permitting direct determination of statistics, forced oscillation of nonlinear systems, and laminar flow transition to turbulence or chaos. Work on wave propagation in thin elastic structures, and nonlinear wave motion in air will be explored also by asymptotic techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0006, FINITE-ELEMENT ANALYSIS OF TRANSONIC FLOWS 14371-M
G.J. FIX, Carnegie Mellon University, Mellon Institute of Science, *Pittsburgh, Pennsylvania* 15213 (DA0E9249; DAAG29 77 G0026)

To investigate the numerical solution of the partial differential equations describing transonic flow. Relevance - the subject matter has clear relevance to many Army flight problems including flows around rotors, missiles and artillery projectiles.

A new variational principle will be implemented which has certain desirable properties when used in conjunction with the finite-element method. This variational principle will be investigated first in the two-dimensional case and then later in the three-dimensional case.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, COHERENT X-RAYS BY STIMULATED EMISSION OF RADIATION 15274-P
M.O. SCULLY, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (DA0F9007; DAAG29 77 G0153)

To measure plasma densities and the number densities of cesium in a charge exchange X-ray scheme. Relevance - this program parallels Army in-house interests in the generation of X-rays for weapons simulation and the potential X-ray laser.

An improved apparatus has been designed to obtain more reliable measurements of the X-ray emission at 584 Angstroms from the interaction region between the plasma and cesium constituents. Measurements of the plasma densities and number densities of cesium will be obtained with this equipment.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0002, ANISOTROPIC AND ELECTROOPTICAL EFFECTS IN LIQUID CRYSTALS
J.D. MARGERUM, Hughes Aircraft Company, *Malibu, California* 90265 (DF046390; F49620-77-C-0017)

AF function - the Air Force capabilities in flight operations rely on continuing advances in navigation, guidance, reconnaissance, and surveillance programs. Deficiency - there is a continuing need for new methods, techniques, and devices for the automatic capability in recognizing data patterns and new information. Objective - research is concerned with the chemical and physical structural effects of liquid crystalline components on the related electrooptical properties. How work contributes - results will contribute to the device work on liquid crystals projects on developing flat-panel matrix displays for airplane cockpits, electronic reticles for fire control systems and screen projection displays.

This research is directed toward understanding of the effects of dopant and liquid crystal structures on the anisotropic properties involved in electrooptical effects. A study is to be carried out on the effect of size, shape, and structure of conductive dopants and the effect of chemical structure variations in liquid crystals, using selected liquid crystals and selected dopants, respectively, on the conductive anisotropy of each. The effect of the conductivity anisotropy ratio on the dynamic scattering characteristics of various liquid crystals/dopant systems in transparent cells with surface alignment will be investigated along with the cybotactic nematic phase character in liquid crystal mixtures. The effects of temperature on their dynamic scattering response will also be studied.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0003, COMMUNICATIONS - RADIATION AND RELATED PROCESSES IN PLASMAS AND THEIR ROLE IN SOLAR ACTIVITY
P.A. STURROCK, Stanford University, School of Hum. & Sciences, *Palo Alto, California* 94305 (DN123312; N00014-75-C-0673)

Navy communications, navigation, surveillance, and magnetic anomaly detection systems are degraded or completely disrupted by ionospheric and magnetospheric disturbances caused by solar flare activity. The objective of this program is to develop an improved understanding of the physical processes of flares to allow improved prediction of flare occurrence and magnitude.

Theoretical models of energy conversion and particle acceleration mechanisms such as field reconnection and electromagnetic radiation from flares are developed. The results are compared with existing experimental data. A general theoretical model of the solar atmosphere, including flare regions, coronal holes, and X-ray bright points is under development.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0004, ELECTRONIC STRUCTURE OF TERNARY ALLOYS 12454-MS
L.V. AZAROFF, Univ. of Connecticut, Graduate School, *Storrs, Connecticut* 06268 (DA0K5575; DAAG29 77 G0161)

To determine the electronic structures of ternary Fe-Ni-Al alloys by combining the experimental procedures of X-ray absorption sepctroscopy (k and l spectra) with X-ray isochromats. Relevance - the proposed research on the electronic structure of ternary iron-nickel-aluminum alloys is directly relevant to the mission of three Army laboratories in the area of magnetic materials. An understanding of the electronic structure of these alloys provides a basis for predicting their magnetic properties. These alloys, known as permalloys, are used by the Army in scratch memory pads, magneto-resistive detectors of magnetic bubbles, inductive components for rf (radio frequency) equipment, etc.

The program will include, but will not be limited to, the following: (1) measurement of the k and l spectra of iron and nickel and the k spectra of aluminum, using the two-crystal vacuum X-ray spectrometer, for various Fe-Ne-Al alloys, (2) measurement of the continuum isochromats of Fe, Ni, and Al in each alloy,

using X-ray excitation and scanning the fine structure of the continuous spectrum near the short-wavelength edge or monitoring the bremsstrahlung intensity as a function of excitation potential.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0005, THERMAL PROPERTIES OF INTERCALATED GRAPHITE COMPOUNDS

D.G. ONN, Univ. of Delaware, School of Arts & Sciences, *Newark, Delaware* 19711 (DF049480; AF-AFOSR-3393-77)

AF function - airborne systems utilized for command, control, communications, reconnaissance and surveillance depend heavily upon interconnected electronic components. Opportunity - improved performance of these systems can be expected from the use of lighter materials such as intercalated graphite compounds for electrical conductors. Objective - the objective is to contribute to the understanding of the basic physical properties of intercalated graphite compounds. How work contributes - intercalated graphite compounds, weighing about one fourth of that of copper, have the potential of having conductivities greater than that of copper. This work should contribute to the development of intercalated graphite compounds that could replace copper as the dominant electrical conductor for airborne systems.

A systematic understanding of the thermal properties of both donor and acceptor type intercalated graphite compounds will be obtained. The specific heat will be determined for well-characterized single-crystal samples of selected intercalated compounds of both donor and acceptor types over the temperature range 0.4K to 300K, providing information on the electronic density of states and on phonon properties as reflected in the debye temperature. In addition the thermal conductivity and the thermoelectric power will be determined for these materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0006, QUANTUM OPTICS

W.L. FAUST, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN220140)

New techniques for generation/control of laser radiation, particularly for short pulses of high intensity. In studies of materials, use lasers to investigate nonlinear responses, very fast optically-induced processes, and transient species. The Navy has a continuing need for new sources of optical radiation and for information characterizing the physical properties of materials of interest.

For studies of materials, establish sources of pulse pairs with variable frequencies, and other adjunct capabilities for synchronous excitation, probe interrogation, and gated detection. Study damage center population development following irradiation. Study fast photochemical processes and transient intermediates. Perform excited-state spectroscopic measurements on atoms.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0007, LARGE BEAM - PLASMA EXPERIMENT (SEEBIE)

A.E. ROBSON, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN320102)

The primary objective of the SEEBIE electron beam plasma interaction experiment is to assess the usefulness of high-current relativistic electron beams for heating and preheating large volumes of plasmas which are to be used in soft X-ray radiation generators. A secondary objective is to study and reach a full understanding of the interaction of relativistic electron beams with relatively dense plasmas. An understanding of these interactions will provide the basis for further advances in the field of electron and ion beam weapons.

A high-energy beam of electrons (100 ka, 1.2 mev, 70 nsec) is injected into a plasma and excites instabilities that convert the beam energy into plasma thermal energy.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0008, BASIC STUDIES OF ATOMIC DYNAMICS

U. FANO, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637 (EY-76-S-02-1674)

This continuing project tries to unravel the correlations between the motions of different particles and the energy exchanges between different types of motion in electron collision and photoabsorption processes. The next major task which is contemplated is to concentrate effort toward achieving two distinct substantial advances on the theory of joint excitation and correlations of an electron pair. Other sustained efforts will be directed to the application of atomic points of view to solid-state problems and to the unraveling of the mechanism of atomic orientation by collision.

RESULTS: Since October 1, 1976 seven papers published or in the process of publication are identified as COO-1674-123, 124, 125, 130, 131, 132, and 136. Numbers 126, 127, 128, 129, are abstracts of papers presented at various conferences. Numbers 133, 134, and 135, are talks presented at various conferences and are to appear in print.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0009, MULTIPLE NUCLEAR BURST MODELING OF ENERGETIC ELECTION INJECTION INTO THE MAGNETOSPHERE

K.I. GOLDEN, Northeastern University, School of Engineering, *Boston, Massachusetts* 02115 (DF048440; F19628-76-C-0246)

AF function - survivability of space-borne systems. Deficiency -inadequate knowledge of the environment produced by multiple exoatmospheric nuclear bursts and the interaction of the radiation fluxes produced with advanced operational space systems as spelled out in the Air Force requirements document for nuclear weapons research. Research - environmental consequences of multiple nuclear burst and the interaction with space systems. How research contributes - the effects on particle trapping and loss from wave-particle interaction in the plasmas produced by multiple nuclear bursts are determined and the interaction of these radiation fluxes with space system is investigated. The streaming instabilities due to the coupling of collisionless debris plasma to collisional plasma are studied for the situation of a second nuclear explosion occurring inside a magnetic field-free contracting plasma bubble and particle fluxes calculated. The wave modes produced, have been identified, and their effects on particle trapping, heating and loss have been studied; these results are being applied to determine their interaction with a high-altitude space system.

Exoatmospheric nuclear burst weapon debris particles injected to high altitudes will experience plasma instabilities between the expanding debris ions and background ionized air neutrals. The resulting energetic electrons will act as a source of electron injection into the van Allen belts. Streaming instability interactions between the expanding debris ions and the background ions generate plasma turbulence. The turbulent modes will stochastically heat the resonant fraction of plasma electrons trapped in the interpenetrating field. The nonlinear wave-resonant particle interaction will determine the electron flux levels experienced by high-altitude satellites. Turbulence will be generated by numerous plasma streaming instability interactions. The research is an analysis of this turbulent collisionless injection mechanism and how it is modified when two or more nuclear devices are detonated in near proximity at high altitude and the nature of the interaction of this injected high-energy plasma and Air Force space systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0010, HIGH-PRESSURE FAR-INFRARED & LIGHT SCATTERING SPECTROSCOPY OF PHONON SELF-ENERGIES IONIC & PIEZOELECTRIC FERROELECTRIC MATERIALS (ABBREV)

R.P. LOWNDES, Northeastern University, School of Liberal Arts, *Boston, Massachusetts* 02115 (DA0M5578; DAAG29 75 G0166)

To investigate the influence of lattice anharmonicity in weakly anharmonic systems, like the alkali and thallium halides,

and in more strongly anharmonic systems such as the piezoelectric hydrogen bonded ferroelectrics. Relevance - the proposed program is relevant to the Army interest in developing a fundamental understanding of ferroelectric materials. These materials are the basis for operation of several electrooptic controls such as shutters, modulators, optical filters, parametric frequency converters, optical deflectors, and transducers. In addition, Picatinny Arsenal indicates interest in lattice dymanics as a part of their work in the explosives laboratory.

Using far-infrared and light-scattering spectroscopy and exploiting the variable of high pressure to probe the consequences of lattice anharmonicity by measurement of the temperature and frequency dependence of the anharmonic self-energies associated with near zero momentum transverse optic modes in alkali and thallium halides and hydrogen bonded ferroelectric arsenate such as KH sub 2 AsO sub 4.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0011, A STUDY OF THE PT-GAAS INTERACTION
R.J. BELL, Univ. of Missouri, School of Arts & Sciences, *Rolla, Missouri* 65401 (DF042610; AF-AFOSR-2938-76)

AF function - microwave solid-state electronics devices are essential elements of Air Force surveillance, electronic countermeasure, and communication systems. Opportunity - the Pt-GaAs Schottky barrier Impatt diode shows great promise for improving the performance of these systems in the microwave region. However, at operating temperature of the Impatt atoms migrate across the PtGaAs interface to form a PtAs2-GaAs Schottky barrier plus layers of PtGa of various composition on the Pt side of the original Pt-GaAs Schottky barrier. This complicated reaction between the Pt and GaAs produces significant device performance degradation. Objective - the objective of this research is to understand the nature of the atomic migration at the Schottky barrier so that the resulting adverse effects can be minimized. How work contributes - this research will provide knowledge which could be used to minimize the adverse effect of atomic migration at the Schottky barrier.

This research investigates the above reaction as a function of heat treatment using surface electromagnetic wave, infrared reflectance and Auger electron spectroscopy plus secondary ion mass spectroscopy (SIMS) and theoretical analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0012, ION IMPLANTATION IN PEROVSKITE-TYPE FERROELECTRICS 14313-P
R. GERSON, Univ. of Missouri, School of Arts & Sciences, *Rolla, Missouri* 65401 (DA0E9273; DAAG29 77 G0001)

To investigate the effect of ion implantation of ferroelectric crystals such as some of the standard barium titanate-type materials and some electrooptic materials like lithium niobate, lithium tantalate and bismuth titanate. Relevance - there is a growing body of information which suggests that a good deal of the standard ferroelectric, piezoelectric, pyroelectric properties are, either in whole or in part, dependent on the surface properties of these materials. There are some arguments that suggest that modification of these surfaces would provide a whole new class of devices. Piezoelectrics are used as fuze initiators and pyroelectrics are used as IR detectors.

A broad range of perovskite-type ferroelectric materials will be implanted with hydrogen, oxygen, helium and P and N type metallic dopants. The properties of these materials will then be studied to evaluate some of their device potential.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0013, ANGULAR RESOLVED ELECTRON EMISSION STUDIES OF MICROWAVE MATERIALS
G.J. LAPEYRE, Montana State University, School of Letters & Sciences, *Bozeman, Montana* 59715 (DF041290; F49620-77-C-0125)

AF function - modern aerospace electronic systems depend heavily upon solid-state electronic and optical devices. Opportunity - future improvement in performance of these devices requires a thorough understanding of the electronic structure and excitation processes in selected solids. Present solid-state electronic and optical devices are based upon the properties of a relatively small percentage of the total number of materials potentially available. Objective - the objective of this research program is to provide knowledge on the electronic structure, electronic transitions and interaction, and optical properties for both the bulk and surface states of materials currently under investigation for microwave devices. How work contributes - it is anticipated that this research will provide knowledge which could lead to improvement in solid-state devices that depend on surface effects such as the behavior of junctions and vapor films.

This research program experimentally investigates bulk and surface electronic and optical properties of stannic oxide, III-IV semiconductors, and single-crystal metals using innovative photoemission techniques in the 2 to 125 ev photon range, Auger electron spectroscopy, low-energy electron diffraction and energy band analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0014, FREE SURFACE PROPERTIES OF III-V COMPOUND SEMICONDUCTOR SURFACES 14710-EL
P. MARK, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DA0F8982; DAAG29 77 G0116)

To investigate free surface properties of 3-5 compound semiconductors and related 2-6 materials. Relevance - this research addresses unresolved questions in the area of those semiconductor surfaces which are of eminent importance to military electron devices using, e.g., field effect transistors or photocathodes.

The crystallography of ordered, non-polar surfaces will be investigated via low-energy electron diffraction and Auger electron scattering systems. The effect of bonding ionicity and surface order/disorder on free surfaces and on the formation of Schottky barriers will be studied.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0015, EXCITATION STUDIES AND MASS SPECTROMETRY OF PLASMAS
J.F. PRINCE, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF458830)

AF function - communication, weaponry, illumination. R.F. effect in communications, nuclear weapons effects. Deficiency - lack of knowledge on excitation, ionization and dissociation processes in gas discharge lasers and the upper atmosphere especially under energetic conditions. Research - mass analysis of gas discharges relevant to molecular gas discharge lasers. Direct and cumulative excitation cross sections. How research contributes - improved gas discharge laser systems and improved understanding of atmospheric processes.

A modulated molecular beam mass spectrometer is used to monitor the relative and absolute concentrations of various molecular species existing in typical laser plasmas. Neutral, ionic, and reactive species are measured under carefully defined plasma conditions. Time-resolved observations of the species concentrations allows direct analysis of dissociation and association rates. Phase-sensitive detection of the modulated beam and use of a low-energy, efficient ionizer assures unambiguous measurement of the true plasma ions and neutral concentrations. Direct and cumulative excitations of atomic and molecular gases are measured using a dual electron beam system interacting with a molecular beam. A high-speed pumping system allows measurement of these cross sections in dissociating gases. Photon counting, synchronous detection, and sophisticated digital data handling techniques are used to obtain and analyze reliable data. A low-energy electron analyzer permits direct measurement of elastic and inelastic scattering of electrons by atoms and molecules. This instrument has a resolution of better than 0.03 ev and is capable of resolving resonant states of atoms and molecules. Data from

these experiments is used to improve existing theoretical models of noniequilibrium plasmas and to aid in the analysis of the plasma properties of discharge lasers. Direct and cumulative excitation and ionization measurements lead to a better understanding of the effects of natural and man-made ionospheric disturbances.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, TRANSFER OF SOLAR RADIATION IN CUMULUS CLOUDS WITH APPLICATION TO THE GATE

T.B. MCKEE, Colorado State University, School of Engineering, *Fort Collins, Colorado* 80523 (ATM76-80568)

The objective of this research is to study the interaction of solar radiation with clouds of similar vertical and horizontal dimensions. Observations of scattered solar radiation emanating from clouds during the Global Atmospheric Research Program's (GARP) Atlantic Tropical Experiment (GATE) will be compared with calculations from a computer model to verify model application in the atmosphere. Some additional radiation observations will be made during the summer of 1977 from the National Center for Atmospheric Research's (NCAR) Queen Air. These will serve to fill in some gaps that exist in the GATE data set.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0002, STRUCTURE OF THE LOCAL UNIVERSE AND THE STATISTICAL PROPERTIES OF GALAXIES

R.B. TULLY, Univ. of Hawaii, Inst. for Astronomy, *Honolulu, Hawaii* 96822 (AST76-12159 A01)

The radiation emitted by neutral hydrogen (HI) has been detected from 1000 nearby galaxies, the vast majority of them observed for redshifts at radio wavelengths for the first time. The combination of these results with approximately 600 redshifts in the literature will make it possible to map the extragalactic neighborhood out to distances where galaxies are thought to recede at a velocity of 3000 km/s in much greater detail than possible previously. For redshifts corresponding to 1000 km/s our sample should be complete for all but extreme systems (e.g., the smallest dwarfs or compacts).

In addition to the redshift, hydrogen flux (HI mass) and a profile width (elated to total mass) will be measured. Of major importance is a correlation discovered between the profile width and absolute galaxian luminosity which promises to provide a superior method of obtaining distances to galaxies. Consequently, it is potentially possible to locate all of the measured galaxies three-dimensionally in space independently of redshift.

Major questions this wealth of data will help resolve are: a) How do galaxies tend to group, on scales from small groups through to the supercluster? b) Are these groups or the supercluster stable or dissipating? c) How much angular momentum do groups or the supercluster contain? d) Is the Hubble expansion isotropic locally and what is the Hubble Constant? e) Is there evidence within groups of non-Doppler redshifts? f) What is the luminosity function of galaxies based on this 'complete' sample? g) What are the statistics of the morphological properties of galaxies, including peculiarities?

This is a continuation of research done under grant AST 76-12159.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, A DOPPLER RADAR/AIRCRAFT STUDY OF PLANETARY BOUNDARY LAYER GROWTH

P.H. HILDEBRAND, Univ. of Illinois, Graduate School, *Urbana, Illinois* 61801 (ATM76-24236)

An experimental study of planetary boundary layer (PBL) growth dynamics is proposed. The experiment will use gust-probe equipped aircraft and Doppler radars to measure the temperature, humidity and air motion characteristics of the PBL several times a day on several days. The days will be chosen so as to minimize the disturbing effects of fronts or deep convection.

An aircraft will be used to drop radar signal reflecting chaff and to measure the means and fluctuations of temperature, humidity, and momentum as a function of height above ground. These data will be used to evaluate the turbulent energy balance equation for the PBL and to calculate the spectra, cospectra, and fluxes of heat, humidity and momentum. These calculations will be used to evaluate the relative importance of various sources and sinks of energy within the growing PBL. The results of currently existing numerical PBL models will be compared with this experiment.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0004, RADIO ASTRONOMICAL OBSERVATIONS OF GALACTIC AND EXTRAGALACTIC RADIO SOURCES

F.T. HADDOCK, Univ. of Michigan, School of Lit. Sci. & The Arts, *Ann Arbor, Michigan* 48104 (AST76-24638 A01)

Flux density measurements of extragalactic radio sources have been made regularly since 1961 and will be continued at lambda lambda 2.1cm, 3.8cm and 6.2cm. These measurements will determine the radio spectra of interesting objects at centimeter wavelengths and detect variation with time. The polarization characteristics and variation of these objects determined by accurate measurements of circular polarization and multifrequency measurements of linear polarization will be continued with substantially improved measurement sensitivity. The relationship of linear polarization variations to the source flux densities and to the structures observed by very-long-baseline interferometry will be investigated. Circularly polarized emission at lambda 3.8cm in several variable sources and two other sources have exhibited significant changes of their circular polarization during the time period of measurement.

Emphasis will continue to be placed upon obtaining multifrequency linear polarization, circular polarization and flux density measurements of extragalactic objects. Observations must be made often since the spectra of some of these objects change in time intervals as short as a week at centimeter wavelengths. In addition, monitoring of a number of galactic objects such as Cygnus X-3, which have exhibited rapid variations in flux and large changes in linear polarization, will be continued. This action provides additional funding and extends the duration of the grant AST 76-24638.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, COSMIC RAY SHOWERS

K.E. TURVER, Univ. of Durham, *Durham, England, United Kingdom* (DA0D9345; DAERO 77 G0068)

To observe and study the atmospheric 'Cerenkov' radiation produced by cosmic ray showers.

To undertake field observations in the next several months on the range at Dugway Proving Ground, Dugway, Utah. This will be joint between the University of Durham and University of Utah.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

GENERAL

11.0001, LILIENTHAL AND THE AMERICANS

T.D. CROUCH, Smithsonian Institution, *Washington, District of Columbia* 20560

Project will result in a scholarly essay on the impact of Otto Lilienthal on American Aeronautics. The essay will be used as a forward to the published English translation of Gustav Halle's biography of Lilienthal. Translation of total work is now underway. MIT Press is interested in publishing finished volume.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N78-28043*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
ACOUSTIC TESTS OF DUCT-BURNING TURBOFAN JET NOISE SIMULATION Final Report
P. R. Knott, E. J. Stringas, J. F. Brausch, P. S. Staid, P. H. Heck, and D. Latham Jul. 1978 345 p refs
(Contract NAS3-18008)
(NASA-CR-2966; DOC-R77AEG524) Avail: NTIS HC A15/MF A01 CSCL 20A

The results of a static acoustic and aerodynamic performance, model-scale test program on coannular unsuppressed and multielement fan suppressed nozzle configurations are summarized. The results of the static acoustic tests show a very beneficial interaction effect. When the measured noise levels were compared with the predicted noise levels of two independent but equivalent conical nozzle flow streams, noise reductions for the unsuppressed coannular nozzles were of the order of 10 PNdB; high levels of suppression (8 PNdB) were still maintained even when only a small amount of core stream flow was used. The multielement fan suppressed coannular nozzle tests showed 15 PNdB noise reductions and up to 18 PNdB noise reductions when a treated ejector was added. The static aerodynamic performance tests showed that the unsuppressed coannular plug nozzles obtained gross thrust coefficients of 0.972, with 1.2 to 1.7 percent lower levels for the multielement fan-suppressed coannular flow nozzles. For the first time anywhere, laser velocimeter velocity profile measurements were made on these types of nozzle configurations and with supersonic heated flow conditions. Measurements showed that a very rapid decay in the mean velocity occurs for the nozzle tested. J.M.S.

N78-28044# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1977-5
May 1978 114 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-5, Sep.-Oct. 1977 p 259-326 Original French report available from ONERA, Paris FF 30
(ESA-TT-459) Avail: NTIS HC A06/MF A01

Main topics include aerodynamically generated noise, especially jet noise, flow in a hydraulic model of an axial turbomachine, two-axis tensile test machine for static and dynamic tests, and validation of a model of a human pilot. For individual titles, see N78-28045 through N78-28050.

N78-28045 European Space Agency, Paris (France).
AERODYNAMICALLY GENERATED NOISE, ESPECIALLY JET NOISE **c07**
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-5 (ESA-TT-459) May 1978 p 1-15 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-5, Sep.-Oct. 1977 p 259-265 Original report in FRENCH previously announced as A78-16618 (For primary document see N78-28044 19-01)
Avail: NTIS HC A06/MF A01

A method for studying the acoustic field emitted by a turbulent jet is proposed. The method, based on a detailed analysis of the local mechanisms which relate turbulence and entropy fluctuations to the acoustic field, takes into account the effects of the heterogeneity of the entropy distribution. A disadvantage of the method is that it complicates treatment of the wave equation. It is thought that use of the method will improve analysis of the directional effects of the Doppler-Fizeau effect. Topics analyzed include the effects of an air jet in air, the heterogeneity of entropy, and turbulent and acoustic agitation; and equation for aerodynamic noise was derived. Author (ESA)

N78-28046 European Space Agency, Paris (France).
FLOW IN A HYDRAULIC MODEL OF AN AXIAL TURBOMACHINE **c07**
Henri Werle and Marc Gallon *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-5 (ESA-TT-459) May 1978 p 16-47 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-5, Sep.-Oct. 1977 p 267-288 Original report in FRENCH previously announced as A78-16619 (For primary document see N78-28044 19-01)
Avail: NTIS HC A06/MF A01

An hydraulic tank apparatus used for testing models of axial turbomachines at low speeds is described; some test results are presented. A suitable choice of mountings permits visualization of internal flow for various operating modes of an isolated blade row: fixed row, mobile row, rotating stall regime, and others. The tests reveal the physical pattern of the flow and its evolution as a function of parameters such as the Reynolds number and velocity coefficient. Other experiments study fixed or mobile elements such as stator vanes, measuring probes, and supporting masts, placed in front of or behind the row.
Author (ESA)

N78-28047 European Space Agency, Paris (France).
NUMERICAL CALCULATION OF THREE-DIMENSIONAL UNSTEADY FLOWS WITH VORTEX SHEETS **c02**
Colmar Rehbach *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-5 (ESA-TT-459) May 1978 p 48-66 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-5, Sep.-Oct. 1977 p 289-298 Original report in FRENCH previously announced as A78-16620 (For primary document see N78-28044 19-01)
Avail: NTIS HC A06/MF A01

An important problem in the development of numerical methods for calculating three-dimensional high Reynolds number separated flows involves taking into account the vortex sheets generated by lifting obstacles in an incompressible flow with evanescing viscosity. Existing calculation methods approach this problem by means of surface distributions of horseshoe vortex or doublet type singularities. The approach proposed here is based on a volume discretization of the vortex vector which, in three-dimensional flow, will vary with time as a function of the local distortions of the velocity field in a manner consistent with the conservation theorems pertaining to vortex flows. The theoretical bases are reviewed, and the Lagrangian integro-

differential formulation is established so as to permit following the evolution in time of a discrete distribution of fluid particles, each carrying a vortex vector. The numerical process is applied to the calculation of the sheet and the aerodynamic coefficients of a low-aspect-ratio rectangular flat plate. The case of instantaneous setting in motion is treated as is the case of a sinusoidal variativn of angle of attack. Sheet formation occurs either at the trailing edge and along the wing tip or all around the wing edges. Author (ESA)

N78-28048 European Space Agency, Paris (France).
TWO-AXIS TENSILE TEST MACHINE FOR STATIC AND DYNAMIC TESTS c39
Madeleine Chaudonneret, Philippe Gilles, Roger Labourdette, and Humbert Policella *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-5 (ESA-TT-459) May 1978 p 67-76 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-5, Sep.-Oct. 1977 p 299-305 Original report in FRENCH previously announced as A78-16621 (For primary document see N78-28044 19-01)
Avail: NTIS HC A06/MF A01

The tensile test facility described is capable of applying tension forces along two mutually perpendicular directions. Studies of crack paths and stress concentrations in two-dimensional structures subjected to two-axis loads are reported with comparison of theoretical and experimental results. In static conditions the machine can exert 200 kN in each direction; for dynamic testing, 160 kN up to 15 Hz. Author (ESA)

N78-28049 European Space Agency, Paris (France).
EXPERIMENTAL CHARACTERIZATION OF MATERIALS UNDER CYCLIC LOADING AT HIGH TEMPERATURE c39
Jean-Louis Chaboche and Humbert Policella *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-5 (ESA-TT-459) May 1978 p 77-108 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-5, Sep.-Oct. 1977 p 307-324 Original report in FRENCH previously announced as A78-16622 (For primary document see N78-28044 19-01)
Avail: NTIS HC A06/MF A01

The technological solutions adopted at ONERA for the design and development of tension-compression fatigue testing machines are presented and discussed: cylindrical specimens, heating by high frequency induction, measurement of axial elongation, and definition of a useful length. All these problems are approached on a macroscopic point of view, i.e., the testing methods are established with a view to modelizing the behavior or an homogeneous volume element. The possibilities of the device are illustrated by a number of tests on the IN 100 refractory alloy in the 700 to 1110 C temperature range, on the INCO 718 alloy at 550 C, and on TA6V at 350 C, these results concerning both cyclic behavior and rupture behavior under various loadings: imposed force or displacement, low or high frequency, and cycles including hold times. In order to give a concrete aspect to this descriptive presentation, with a view to its application to structural calculations, some experimental results are interpreted along various phenomenological models. Author (ESA)

N78-28050 European Space Agency, Paris (France).
VALIDATION OF A MODEL OF A HUMAN PILOT c54
Dominique Soulatges *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-5 (ESA-TT-459) May 1978 p 109-111 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-5, Sep.-Oct. 1977 p 325-326 Original report in FRENCH previously announced as A78-16623 (For primary document see N78-28044 19-01)
Avail: NTIS HC A06/MF A01

A sequential model of a human pilot is presented which takes into account the limits of human capacity for acquiring and memorizing information and puts into operation a certain strategy of action based on knowledge of the piloted vehicle and of the desired operation. The model was tested for operation of a LEM-type vehicle; the abilities of the robot and of human pilots to perform identical tasks were compared. A suitably close similarity of performance was found. Author (ESA)

N78-28051# RAND Corp., Santa Monica, Calif.
THE MILITARY UTILITY OF VERY LARGE AIRPLANES AND ALTERNATIVE FUELS
William T. Mikolowsky, Larry W. Noggle, and William L. Stanley Sep. 1977 29 p refs
(AD-A053604; P-5994) Avail: NTIS HC A03/MF A01 CSCL 01/3

The specific objectives of this work were: Evaluate very large airplanes (VLAs) in the context of existing and possible future Air Force missions, and determine the most attractive alternative fuel for airplanes of this type. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N78-28052*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF CAMBER ON THE TRIMMED LIFT CAPABILITY OF A CLOSE-COUPLED CANARD-WING CONFIGURATION
Blair B. Gloss Jul. 1978 94 p refs
(NASA-TM-78686; L-12102) Avail: NTIS HC A05/MF A01 CSCL 01A

A close-coupled canard-wing configuration was tested in the Langely high-speed 7 by 10 foot tunnel at a Mach number of 0.30 to determine the effect of changing wing camber on the trimmed lift capability. Trimmed lift coefficients of near 2.0 were attained; however, the data indicated that the highest buffet-free trimmed lift coefficient attainable was approximately 1.30. The buffet used in this investigation were qualitative in nature and gave no indication of buffet intensity. Thus, the trimmed lift coefficient of near 2.0 might be attainable if the buffet intensity was not too high. The data showed that there was approximately a 10 percent variation in drag coefficient, for different model configurations, at a given trimmed lift coefficient. Large increases in wing lift had only small effects on canard lift. Author

N78-28053*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WING ANALYSIS USING A TRANSONIC POTENTIAL FLOW COMPUTATIONAL METHOD
P. A. Henne (McDonnell Douglas Corp., Long Beach, Calif.) and R. M. Hicks Jul. 1978 60 p refs
(NASA-TM-78464; A-7308) Avail: NTIS HC A04/MF A01 CSCL 01A

The ability of the method to compute wing transonic performance was determined by comparing computed results with both experimental data and results computed by other theoretical procedures. Both pressure distributions and aerodynamic forces were evaluated. Comparisons indicated that the method is a significant improvement in transonic wing analysis capability. In particular, the computational method generally calculated the correct development of three-dimensional pressure distributions from subcritical to transonic conditions. Complicated, multiple shocked flows observed experimentally were reproduced computationally. The ability to identify the effects of design modifications was demonstrated both in terms of pressure distributions and shock drag characteristics. G.G.

N78-28054*# Northrop Corp., Hawthorne, Calif. Aircraft Group.
AERODYNAMIC CHARACTERISTICS OF A JET SHEET VORTEX GENERATOR
H. Ziegler and P. T. Wooler Jun. 1978 60 p refs
(Contract NAS1-14216)
(NASA-CR-158904; NOR-78-24) Avail: NTIS HC A04/MF A01 CSCL 01A

A configuration concept for augmenting the lift capability of low aspect ratio, thin wings, typically used on fighter aircraft was investigated. The fluid strake concept uses a jet sheet formed by blowing from a series of small orifices located in the side of the fuselage ahead of the wing to generate a stable vortex flow over the wing at high angle of attack. The effect of the location of the fluid strake relative to the wing was investigated for

three different designs of the in-line orifices using a half-span model tested in a 7 by 10 foot low speed tunnel. Based on the results of the low speed test, a jet sheet producing module was incorporated into a NASA general research fighter model and tested in the Langley 7 by 10 foot high speed tunnel to determine the effectiveness of the fluid strake as a lift-enhancement device in the high-speed maneuver regime. Tests were conducted over a Mach number range from 0.3 to 0.8, with a jet momentum coefficient range from 0 to 0.24. Significant lift increments resulted at the higher angles of attack and drag polars were improved.
A.R.H.

N78-28055*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
AN IMPROVED ANALYTICAL MODEL OF THE SEPARATION REGION ON BOATTAIL NOZZLES AT SUBSONIC SPEEDS Final Report
Walter M. Presz, Jr., Ronald W. King, and John D. Buteau Jul. 1978 86 p refs
(Contract NAS1-14462)
(NASA-CR-3028; PWA-5599) Avail: NTIS HC A05/MF A01 CSCL 01A

A practical engineering calculation was developed to model the viscous effects of a separated, reverse flow region on afterbody pressures and drag. This viscous calculation was iteratively coupled with an inviscid flow calculation by means of an aerodynamic interface. A standard boundary layer displacement thickness was used to modify the afterbody shape where the flow was attached. A discriminating streamline calculation was developed to account for displacement effects of the reverse flow in separated regions with and without a flowing jet. The viscous flow calculation was coupled with a potential flow calculation. The analysis accurately predicted afterbody pressures and drag with variations in Reynolds number, Mach number, and afterbody shape. J.A.M.

N78-28056*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ANALYSIS OF THE GUST-INDUCED OVERSPEED TRENDS OF HELICOPTER ROTORS
Julian L. Jenkins, Jr. and William T. Yeager, Jr. (AVRADCOM Res. and Technol. Labs.) Jul. 1978 23 p refs
(NASA-TP-1213; AVRADCOM-TR-78-24; L-12159) Avail: NTIS HC A02/MF A01 CSCL 01A

Equations for analyzing the potential gust-induced overspeed tendency of helicopter rotors are presented. A parametric analysis was also carried out to illustrate the sensitivity of rotor angular acceleration to changes in rotor lift, propulsive force, tip speed, and forward velocity. G.G.

N78-28057*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATIC PERFORMANCE OF FIVE TWIN-ENGINE NONAXISYMMETRIC NOZZLES WITH VECTORING AND REVERSING CAPABILITY
Francis J. Capone Jul. 1978 66 p refs
(NASA-TP-1224; L-12067) Avail: NTIS HC A04/MF A01 CSCL 01A

Transonic tunnel test was performed to determine the static performance of five twin-engine nonaxisymmetric nozzles and a base-line axisymmetric nozzle at three nozzle power settings. Static thrust-vectoring and thrust-reversing performance were also determined. Nonaxisymmetric-nozzle concepts included two-dimensional convergent-divergent nozzles, wedge nozzles, and a nozzle with a single external-expansion ramp. All nonaxisymmetric nozzles had essentially the same statis performance as the axisymmetric nozzle. Effective thrust vectoring and reversing was also achieved. G.G.

N78-28058# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.
EXPERIMENTAL MEASUREMENTS IN THE TURBULENT BOUNDARY LAYER OF A YAWED, SPINNING OGIVE-CYLINDER BODY OF REVOLUTION AT MACH 3.0. PART 2: DATA TABULATION Final Report
Lyle D. Kayser and Walter B. Sturek Mar. 1978 165 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A053458; AD-E430000; ARBRL-MR-02813) Avail: NTIS HC A08/MF A01 CSCL 20/4

This report presents a tabulation of data for the experiment which is fully described in Part 1: Experiment and Data Analysis. The data consist of turbulent boundary layer profile characteristics and wall shear stress for a yawed, spinning slender body of revolution at Mach 3 for angles of attack up to 6.3 degrees. The data tabulations are presented in a format which facilitates their use for comparison to theoretical computations.
Author (GRA)

N78-28059# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.
DESIGN AND ANALYSIS OF A HODOGRAPH METHOD FOR THE CALCULATION OF SUPERCRITICAL SHOCK-FREE AEROFOILS Ph.D. Thesis - Tech. Hogeschool Twente
J. W. Boerstoel 14 Apr. 1977 231 p refs
(NLR-TR-77046-U) Avail: NTIS HC A11/MF A01

An algorithm for the computational design of supercritical shock-free airfoils is developed and analyzed with hodograph theory. Such an algorithm may be based on the combination of two approaches for the construction of solutions of the flow equations for shock-free transonic flow. In this study, an operational method developed by Lighthill, Goldstein, Craggs, Mackie, and Nieuwland is used though. The construction of analytic compressible flow solutions with the operational method selected is discussed. In order to enhance the efficiency of the calculations, new choices were made for the structure of the compressible flow solution. New choices were also made for the normalizing functions depending on the free-stream Mach number of the flow. In order to obtain solutions without Tricomi singularities, the Tricomi boundary value problem is reformulated as an optimal control problem within a space of analytic solutions of the flow equation. Continuity of the airfoil (and its image on the hodograph surface) is obtained with a special error functional that controls the position of a free boundary curve. The approximate solution of the resulting optimal-control problem is discussed and analyzed in detail. Numerical results are presented which show that interesting airfoils are obtained, and that the algorithm performs well. Author (ESA)

N78-28060# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
LAMINAR FLAT PLATE HEAT TRANSFER MEASUREMENTS FROM A DISSOCIATED HIGH ENTHALPY HYPERSONIC AIR FLOW
R. A. East, R. J. Stalker (Queensland Univ., Brisbane), and J. P. Baird (Australian Natl. Univ., Canberra) Oct. 1977 46 p refs Partly sponsored by School of Gen. Studies, A.N.U., and by Min. of Defence, UK
(AASU-338) Avail: NTIS HC A03/MF A01

Heat transfer rates from a nonequilibrium hypersonic air flow to flat plates at zero and 12 deg incidence were measured in a free piston shock tunnel at stagnation enthalpy levels up to 51 MJ/kg. Nozzle flow conditions resulted in test section velocities up to 8.1 km/s in an experimental regime in which the free stream was chemically frozen and the flat plate boundary layer was laminar. Estimates of the gas phase and surface reaction Damkohler numbers were made and the heat transfer results are discussed in this context. Author (ESA)

N78-28061# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
CALCULATION OF LAMINAR BOUNDARY LAYERS ON INFINITE SWEPT WINGS BASED ON THWAITES TWO-DIMENSIONAL METHOD [BERAEKNING AV LAMINAERA GRAENSSKIKT PAA OAENDLIGA SVEPTA VINGAR UTGAAENDE FRAAN THWAITES TVAA-DIMENSIONELLA METOD]
A. Bertelrud 1977 64 p refs In SWEDISH
(Contracts F-INK-82223-75-007-07-001; F-INK-82223-76-001-21-001)
(FFA-AU-1431) Avail: NTIS HC A04/MF A01

A computer program for incompressible laminar boundary layers on infinite swept wings is described. The program was developed to estimate Reynolds number effects for various front edge designs; give plausible initial values for turbulent computer programs; apply and fit various empirical correlations for stability, reversal, relieving, etc.; and give information on the thermal

boundary layer (Smith and Spalding method). The program is an integral one based on Thwaite's two-dimensional method, in which the fundamentals for the equation were taken from literature. It is pointed out that the criteria used to define instability, reversal, etc., must be regarded only as an indication of probable current forms. In the presented version the program is incompressible. Author (ESA)

N78-28062# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Entwurfsaerodynamik.

NEW MODEL UPWIND DISTRIBUTIONS AND THEIR INFLUENCE ON THE DESIGN OF GLIDERS [NEUE MODELLAUFWINDVERTEILUNGEN UND IHR EINFLUSS AUF DIE AUSLEGUNG VON SEGELFLUGZEUGEN]

K.-H. Horstmann Dec. 1976 30 p refs In GERMAN
(DLR-IB-151-76/12) Avail: NTIS HC A03/MF A01

The upwash distribution according to Carmichael, used thus far for calculating the overland flight speed of gliders, was tested critically. Using upwind measurements and taking practical flight test experience into account new model upwind distributions were defined and tested. For gliders of the open and of the standard class the influence of the newly defined upwind distributions on the most important aircraft parameters was recorded. ESA

N78-28063# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Theoretische Aerodynamik.

INITIAL CALCULATIONS FOR THE THEORETICAL INVESTIGATION OF THE HIGH SPEED LOCOMOTIVE E103 [PILOTRECHNUNG ZUR THEORETISCHEN UNTERSUCHUNG DER SCHNELLFAHRLOKOMOTIVE E103]

G. Stoffers Jan. 1978 35 p refs In GERMAN
(DLR-IB-151-77/15) Avail: NTIS HC A03/MF A01

Pressure and velocity distributions at the surface of a simplified model of the high speed locomotive E103 of the German railways were calculated using the panel procedure for compressible frictionless flow with sideslip angles of 0, 5, 10, 15, 20, 25, and 30 deg. The force and moment coefficients were obtained by integration of the pressure distribution over the vehicle surface. The overlap principle was used to develop a procedure with which the velocity and pressure distribution and the coefficients for random sideslip angles can be calculated from only two sideslip angle values obtained with the panel procedure. ESA

N78-28064# European Space Agency, Paris (France).

STRUCTURAL MODIFICATIONS ON A SWEPT WING MODEL WITH TWO EXTERNAL STORES BY MEANS OF MODAL PERTURBATION AND MODAL CORRECTION METHODS

Raymond Freymann May 1978 48 p refs Transl. into ENGLISH of 'Anwend. u. Vergleich modaler Perturbationsmethoden u. modaler Korrekturverfahren am Beispiel eines Pfeilfluegels mit zwei 'Pylonaussenlasten', DFVLR, Goettingen, West Ger. Report DLR-FB-77-21, 27 May 1977 Original report in GERMAN previously announced as N78-18014 Original German report available from DFVLR, Cologne DM 22.60
(ESA-TT-463; DLR-FB-77-21) Avail: NTIS HC A03/MF A01

Investigations on swept wing model structure with two external stores were carried out by applying modal perturbation methods and modal correction procedures to inertia modifications on the external stores. Experimental modal data resulting from ground vibration tests on the same model structure in two different configurations were partially compared with calculated modal data in order to check the accuracy and suitability of the different modification methods. ESA

N78-28065# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

THE LIFTING WING WITH MINIMUM DRAG IN SUPERSONIC FLOW

H. J. Bos Oct. 1977 58 p refs
(VTH-LR-234) Avail: NTIS HC A04/MF A01

An attempt was made to obtain some insight in a proper formulation of a drag minimization problem for thin wings in supersonic flow. If the planform is not fixed the introduction of a few geometrical constraints is shown to be necessary. In analogy with slender body theory an area of entrainment can be introduced. A planform with minimum drag is proved to be a planform with maximum area of entrainment. At the same time some interesting features of the velocity field around an optimum wing and of the corresponding load distribution on the optimum wing are shown. Author (ESA)

N78-28066# National Technical Information Service, Springfield, Va.

AERODYNAMIC FORCES ON MOTOR VEHICLES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1978

Guy E. Habercom, Jr. Apr. 1978 56 p Supersedes NTIS/PS-77/0339; NTIS/PS-76/0376
(NTIS/PS-78/0375/2; NTIS/PS-77/0339; NTIS/PS-76/0283) Avail: NTIS HC $28.00/MF $28.00 CSCL 13F

A bibliography containing 51 abstracts concerning aerodynamic lift drag, and side forces exerted on moving motor vehicles is presented. Forces acting on passing vehicles as well as those acting under and around individual moving vehicles were reviewed. GRA

N78-28067# National Technical Information Service, Springfield, Va.

AERODYNAMIC FORCES ON MOTOR VEHICLES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1978

Guy E. Habercom, Jr. Apr. 1978 96 p Supersedes NTIS/PS-77/0340; NTIS/PS-76/0284
(NTIS/PS-78/0376/0; NTIS/PS-77/0340; NTIS/PS-76/0284) Avail: NTIS HC $28.00/MF $28.00 CSCL 13F

A bibliography containing 89 abstracts concerning aerodynamic lift, drag, and side forces exerted on moving motor vehicles is presented. Forces acting on passing vehicles as well as those acting under and around individual moving vehicles were reviewed. Methods for streamlining vehicle configurations for fuel conservation were suggested. GRA

N78-28047 European Space Agency, Paris (France).

NUMERICAL CALCULATION OF THREE-DIMENSIONAL UNSTEADY FLOWS WITH VORTEX SHEETS

Colmar Rehbach *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-5 (ESA-TT-459) May 1978 p 48-66 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-5, Sep.-Oct. 1977 p 289-298 Original report in FRENCH previously announced as A78-16620 (For primary document see N78-28044 19-01)
Avail: NTIS HC A06/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N78-28068*# Columbia Univ., New York. Dept. of Electrical Engineering and Computer Science.

MICROPROCESSOR UTILIZATION IN SEARCH AND RESCUE MISSIONS Final Report, 27 Sep. 1976 - 26 Sep. 1977

Mischa Schwartz and Theo Bashkow Jan. 1978 75 p refs (Contract NAS5-23727)
(NASA-CR-156788) Avail: NTIS HC A04/MF A01 CSCL 09B

The position of an emergency transmitter may be determined by measuring the Doppler shift of the distress signal as received by an orbiting satellite. This requires the computation of an initial estimate and refinement of this estimate through an iterative, nonlinear, least squares estimation. A version of the algorithm was implemented and tested by locating a transmitter on the premises and obtaining observations from a satellite. The computer used was an IBM 360/95. The position was determined within

the desired 10 km radius accuracy. The feasibility of performing the same task in real time using microprocessor technology, was determined. The least squares algorithm was implemented on an Intel 8080 microprocessor. The results indicate that a microprocessor can easily match the IBM implementation in accuracy and be performed inside the time limitations set. B.B.

N78-28069# Proteon Associates, Inc., Waltham, Mass.
DISTRESS BUOY SYSTEM ANALYSIS Final Report, May 1974 - Sep. 1976
Howard C. Salwen Apr. 1978 23 p refs
(Contract DOT-TSC-929)
(AD-A053676; USCG-D-26-78; TSC-USCG-78-4) Avail: NTIS HC A02/MF A01 CSCL 06/7

This report presents a brief analysis and comparison of two candidate approaches to the implementation of a multiple access Emergency Position Indicating Radio Beacon EPIRB system for maritime use. One approach uses frequency-shift-keyed FSK audio tone pairs for user identification, with detection employing a bank of narrow-band filters. False alarm probabilities and other parameters are calculated for this approach. An alternative to this approach, promising improved performance in the presence of multiple interfering EPIRBs, is also described. This alternative uses orthogonal Pseudo- Noise PN spread-spectrum sequences to identify each EPIRB uniquely. These sequences are easily generated using linear shift registers, and the resulting receiver structure is comparable in complexity with that needed for the FSK approach. It is concluded that the acquisition and detection performance of the two approaches is about equal, but that the spread-spectrum method has advantages in a multiple-access environment. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N78-28070# National Aviation Facilities Experimental Center, Atlantic City, N. J.
TRSB MICROWAVE LANDING SYSTEM DEMONSTRATION PROGRAM AT CAPE MAY, NEW JERSEY, USA Final Report, 27 Sep. 1977 - 8 Oct. 1977
Oct. 1977 31 p
(FAA Proj. 075-725-700)
(AD-A054605; FAA-NA-78-13; FAA-RD-78-13) Avail: NTIS HC A03/MF A01 CSCL 17/7

The small community (SC) time reference scanning beam (TRSB) microwave landing system was demonstrated at the Cape May County Airport. The SC system provides proportional guidance over an azimuth sector of + or - 10 degrees about the runway centerline with clearance signals out to + or - 40 degrees. Proportional guidance is provided in elevation from 2 degrees to 11 degrees. Flydown clearance is provided from 11 degrees to 15 degrees. System coverage is at least 20 nautical miles in heavy rain. Demonstration flights were conducted using a DC-6 and a Twin Otter. Data were collected utilizing a radio theodolite. Results of these tests indicate some of the following: (1) the system required minimal site preparation and installation time; (2) the system was subjectively determined to have very good guidance characteristics; (3) the small community system exceeds its design specifications; and (4) the small community TRSB configuration path and course signal structure meets Category 2 ILS requirements. B.B.

N78-28071# National Aviation Facilities Experimental Center, Atlantic City, N. J.
TRSB MICROWAVE LANDING SYSTEM DEMONSTRATION PROGRAM AT BUENOS AIRES, ARGENTINA Final Report, Oct. - Nov. 1977
Nov. 1977 38 p
(FAA Proj. 075-725-710)
(AD-A054451; FAA-NA-78-14; FAA-RD-78-14) Avail: NTIS HC A03/MF A01 CSCL 01/4

The basic narrow time reference scanning beam (TRSB) microwave landing system was collated with UHF/VHF ILS and at the Jorge Newbery Aeroparque. The system was designed for azimuth proportional guidance plus or minus 40 deg about the runway center line, elevation proportional guidance from 1 degree to 15 degrees, and converge of at least 20 nautical miles in heavy rain. Most of the flights were in the NASA B-737 terminal configured vehicle which recorded TRSB angle data, together with ground tracking data from radio theodolite and optical television tracking equipment. Flight profiles included completely coupled, descending, curved paths to a close-in intercept (2.0 and 1.1 nautical miles) of runway centerline, followed by autoland and roll-out on runway. Results using the basic narrow system are discussed. A.R.H.

N78-28072# National Aviation Facilities Experimental Center, Atlantic City, N. J.
TRSB MICROWAVE LANDING SYSTEM DEMONSTRATION PROGRAM AT TEGUCIGALPA, HONDURAS Final Report, 13-26 Nov. 1977
Nov. 1977 44 p
(FAA Proj. 075-725-755)
(AD-A054452; FAA-NA-78-15; FAA-RD-78-15) Avail: NTIS HC A03/MF A01 CSCL 01/4

The small community time reference scanning beam (TRSB) microwave landing system was demonstrated at Toncontin Airport in Honduras. This configuration provides azimuth proportional guidance plus or minus 10 degrees about the runway centerline, with directional guidance from 10 degrees out to 40 degrees. Elevation proportional guidance from 2 degrees to 11 degrees, with fly-fown clearance from 11 degrees to 15 degrees, is provided. Coverage distance is at least 20 nautical miles under heavy rain. Flights in the NAFEC CV-580 demonstrated three approaches: (1) parallel to runway centerline, offset by 58.5 meters with 4.5 degrees elevation angle; (2) 3 degrees azimuth radial with 4 degrees elevation angle; and (3) 9 degrees azimuth radial with 3.5 degrees elevation angle. In all cases, decision height was 123 meters (400 feet). For this airport and runway, the data indicates that guidance signal quality, with no filtering, is well within ICAO noise requirements for a reduced capability system. A.R.H.

N78-28073# National Aviation Facilities Experimental Center, Atlantic City, N. J.
TRSB MICROWAVE LANDING SYSTEM DEMONSTRATION PROGRAM AT DAKAR, SENEGAL Final Report, 9-15 Feb. 1978
Feb. 1978 54 p
(AD-A054645; FAA-NA-78-21; FAA-RD-78-21) Avail: NTIS HC A04/MF A01 CSCL 17/7

The Time Referenced Scanning Beam (TRSB small community system was installed on the same runway as a commissioned ILS. Flight checks established that no mutual interference resulted. Operational demonstrations and data acquisition flights were made utilizing an FAA Boeing 727 testbed aircraft. Flight profiles included approaches, radials, and partial orbits perpendicular to the runway centerline. Results of the operational demonstrations indicated that the performance of the TRSB small community system configuration was within the design requirements and met the ICAO full capability system requirements. Author

N78-28074# National Aviation Facilities Experimental Center, Atlantic City, N. J.
TRSB MICROWAVE LANDING SYSTEM DEMONSTRATION PROGRAM AT NAIROBI, KENYA Final Report, 19-25 Feb. 1978
Feb. 1978 47 p
(AD-A054646; FAA-NA-78-22; FAA-RD-78-22) Avail: NTIS HC A03/MF A01 CSCL 17/7

The system was flown to Nairobi in an FAA Boeing 727 testbed aircraft and installed on the same runway as a commissioned ILS. Data acquisition and operational demonstration flights were flown with the FAA B 727 aircraft over a period of 5 days (February 20-24 1978). During the flights, a radio telemetry theodolite and an optical electronic tracker were used

for aircraft space position data. Flight profiles included straight in approaches at various elevation angles, level runs at 1500 feet altitude on centerline, and + or - degree offsets, and 10 nautical mile partial orbits at 3500 feet altitude. Results of the flight tests indicate that the performance of the Time Reference Scanning Beam small community system was within design requirements, the ICAO reduced capability system requirements, and the ICAO full capability system requirements. The TRSB system installation did not adversely affect the instrument landing system. Author

N78-28075# National Aviation Facilities Experimental Center, Atlantic City, N. J.
AN EVALUATION OF MODIFIED RNAV TERMINAL PROCEDURES USING A SINGLE-WAYPOINT RNAV SYSTEM Final Report, Jan. - Jun. 1976
Donald Eldredge, Bernard Goldberg, and William Crimbring Apr. 1978 120 p
(FAA Proj. 044-326-340)
(AD-A054510; FAA-NA-77-49; FAA-RD-28-27) Avail: NTIS HC A06/MF A01 CSCL 17/7

Nine pilots participated in a series of flight simulation tests employing solo pilot techniques which were conducted in order to measure Total System Crosstrack (TSCT) and Flight Technical Error (FTE) using a single waypoint area navigation (RNAV) system. The tests were designed to assess pilot performance as a function of routes and route structures (consisting of different combinations of waypoints and/or intersections). Performance was measured on the variables: horizontal tracking and procedural performance. The horizontal tracking data included both steady state and transition data. Author

N78-28076# Transportation Systems Center, Cambridge, Mass.
TOWER-RELATED MAJOR SYSTEM DEVELOPMENT PROGRAMS Interim Report, Apr. - Jun. 1977
D. Clapp, P. Rempfer, D. Devoe, J. Bellantoni, L. Stevenson, R. Coonan, J. Kuhn, J. OBrien, R. Bland, and J. Dumanian Mar. 1978 317 p refs
(AD-A054608; DOT-TSC-FAA-78-2; FAA-EM-77-16) Avail: NTIS HC A14/MF A01 CSCL 17/7

The present and near future states of the tower cab environment are reported, and those MSDP systems which may have an impact on the current tower cab environment, systems and/or operations are addressed. The systems included are: Discrete Address Beacon System (DABS), Airport Surface Detection Equipment 3 (ASDE 3), Tower Airport Ground Surveillance (TAGS), Terminal Information Processing System (TIPS), ARTS 2 and ARTS 3 enhancements, Flight Service Station Automation (FSSA), Vortex Advisory Syteem (VAS), Wake Vortex Avoidance System (WVAS), Wind Shear Detection system (WSD) and Microwave Landing System (MLS). Each system is described in terms of its functional objectives, planned equipment, interfaces with other systems and with controllers, failure modes, and current development/deployment status. G.Y.

N78-28077# Mitre Corp., McLean, Va.
IMPACT OF FAA E AND D ELEMENTS: EIGHT AIRPORT SUMMARY Final Report
A. L. Haines Jan. 1978 67 p refs
(Contract DOT-FA78WA-4075)
(AD-A054245; FAA-EM-78-4; MTR-7350-Vol-3) Avail: NTIS HC A04/MF A01 CSCL 17/7

The potential benefits of implementing the products of selected FAA engineering and development programs at eight major airports were surveyed. Best estimates of the expected performance of the vortex advisory/wake vortex avoidance systems (VAS/WVAS), metering and spacing, and the discrete address beacon systems were used as basis for estimating the increase in airport capacity that mgiht be realized from the collective use of those systems in a pre-1985 case and a post-1985 case. Best estimates of the expected performance of the airport surface traffic control (ASTC) system, the microwave landing system (MLS), and area navigation equipment (RNAV) plus results of recent FAA/TSC studies were used as the basis for estimating the individual impacts of those systems on controller workload, changes in air routes to reduce time and fuel, and ILS interference problems at the eight airports. B.B.

N78-28078# Mitre Corp., McLean, Va. Metrek Div.
ECONOMIC ANALYSIS OF FUTURE CIVIL AIR NAVIGATION SYSTEMS Final Report
Anil N. Joglekar and Karl Seiler, III Dec. 1977 34 p refs
(Contract DOT-FA78WA-4075)
(AD-A054474; FAA-EM-78-6) Avail: NTIS HC A03/MF A01 CSCL 17/7

The economic analyses of three previous FAA/METREK studies related to future domestic air navigation are updated and consolidated. The Airway Facilities Service made significant revisions to both the F&E and O&M cost estimates for VORTAC modernization. The FAA also updated its estimate of distribution of VOR and DME among the general aviation population. This report documents the impact of these changes. The study shows that there is no cost advantage in replacing the present VOR/DME system unless more stringent needs, such as area navigation, coverage and accuracy become necessary. Based on the estimated avionics costs the results show that the total cumulative costs (discounted at 10%) to the user plus government, for the various alternatives studied from the year 1985-2010, range from $695 million for VOR/DME, and $865 million for LORAN-C, to $970 million for GPS. It is further shown that if either LORAN or GPS ever became the primary air navigation system, then keeping the VOR for general aviation for a lengthy transition period would be economically attractive. G.Y.

N78-28079# Intermetrics, Inc., Cambridge, Mass.
COMPARISON OF THREE VERTICAL CHANNEL DESIGNS FOR AN INTEGRATED GPS/INERTIAL NAVIGATION SYSTEM Interim Report, Dec. 1976 - Jul. 1977
William S. Widnall and Prasun K. Shinha Wright Patterson AFB, Ohio AFAL Dec. 1977 83 p refs
(Contract F33615-77-C-1044)
(AD-A053594; IR-234; AFAL-TR-77-208) Avail: NTIS HC A05/MF A01 CSCL 17/7

The Integrated GPS/Inertial (IGI) Simulator is utilized to explore design issues associated with the vertical channel of a GPS/baro/inertial navigation system. The assumed navigation system includes a local-level wander azimuth inertial navigation system with associated barometric altimeter for stabilizing the vertical channel, a Global Positioning System (GPS) pseudo range and range-rate receiver, and a navigation computer hosting a Kalman filter to integrate the baro/inertial and GPS data. The simulated flight path is an F-4 high dynamic tactical mission profile. Of particular interest in evaluating vertical channel performance is a seven minute period during which jamming prevents the use of GPS measurements. Three Kalman filter designs are evaluated. GRA

N78-28080*# Stanford Univ., Calif. Guidance and Control Lab.
STUDY TO DEVELOP GRADIOMETER TECHNIQUES Final Report, Oct. 1976 - Sep. 1977
D. Schaechter, M. Kurosaki, and D. B. Debra Hanscom AFB, Mass. AFGL Dec. 1977 58 p refs
(Contracts NAS5-21960; F19628-76-C-0289; AF Proj. 3201)
(NASA-CR-157304; AD-A053399; AFGL-TR-78-0046; SU-2-DBZ-7215) Avail: NTIS HC A04/MF A01 CSCL 08/5

The primary goal of the current gravity gradiometer research at Stanford has been to establish the feasibility of using a gravity gradiometer with 1 E accuracy, as the primary sensor in various applications. The two applications considered here in detail are geodesy missions and inertial navigation systems. Preliminary sections on gravity models and gravity gradiometer bias estimation are also included. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N78-28081# National Aviation Facilities Experimental Center, Atlantic City, N. J.

TESTS OF CRASH-RESISTANT FUEL SYSTEM FOR GENERAL AVIATION Interim Report, Feb. 1976 - Jun. 1977
William M. Perrella, Jr. Mar. 1978 32 p
(FAA Proj. 184-521-100)
(AD-A054141; FAA-NA-77-48; FAA-RD-78-28) Avail: NTIS HC A03/MF A01 CSCL 01/3

A significant percentage of general aviation aircraft accidents result in post-crash fires due to the ignition of fuel spillage, often contributing injury or death to the aircraft occupants. Testing was performed to demonstrate the performance of light-weight, flexible, crash-resistant fuel cells combined with the use of frangible fuel line couplings. Included in these tests were three full-scale crash tests of a typical light twin aircraft. In all of these tests, the crash-resistant fuel system performed satisfactorily. Author

N78-28082# Lockheed-California Co., Burbank.
FULL SCALE CRASH TEST EXPERIMENT VERIFICATION OF A METHOD OF ANALYSIS FOR GENERAL AVIATION STRUCTURAL CRASHWORTHINESS Final Report, Jun. 1976 - Feb. 1978
Gil Wittlin, Max A. Gamon, and William L. LaBarge Feb. 1978 392 p refs
(Contract DOT-FA75WA-3707)
(AD-A054154; FAA-RD-77-188; LR-28306) Avail: NTIS HC A17/MF A01 CSCL 01C

The results to experimentally verify a method of analysis of the structural dynamics response of general aviation airplanes subjected to a crash environment are presented. A description of the preparation for the performance of four instrumented full scale crash tests involving a single engine, high wing type airplane was also included. The crash tests involved a wide range of impact attitudes and included one impact into a soil covered terrain. Program KRASH, refined for general aviation airplane application is used to mathematically model the single engine, high wing type airplane for each of the crash tests. An analysis of each crash condition was performed and the results with regard to post crash sequence, cg velocity, energy distribution, cabin deformation, member deflections, structure failures, and floor, occupant and engine mass accelerations are presented. Correlation between analysis and test results is described for each crash test. Comparisons of analytical and test results are summarized for the composite of all four crash tests. The analytical results are shown to be in agreement with test results. Conclusions are presented following the summary of results. B.B.

N78-28083*# Gorham Associates, Thousand Oaks, Calif.
STUDY TO DETERMINE OPERATIONAL AND PERFORMANCE CRITERIA FOR STOL AIRCRAFT OPERATING IN LOW VISIBILITY CONDITIONS
John A. Gorham May 1978 63 p refs
(Contract NAS2-8790)
(NASA-CR-152164) Avail: NTIS HC A04/MF A01 CSCL 01C

The operational and performance criteria for civil CTOL passenger-carrying airplanes landing in low visibilities depend upon the characteristics of the airplane, the nature and use of the ground and airborne guidance and control systems, and the geometry and lighting of the landing field. Based upon these criteria, FAA advisory circulars, airplane and equipment design characteristics, and airline operational and maintenance procedures were formulated. The documents are selected, described, and discussed in relationship to the potential low weather minima operation of STOL aircraft. An attempt is made to identify fundamental differences between CTOL and STOL aircraft characteristics which could impact upon existing CTOL documentation. Further study and/or flight experiments are recommended. G.Y.

N78-28084# School of Aerospace Medicine, Brooks AFB, Tex.
MULTIPLE IMAGES IN THE F/FB-111 AIRCRAFT WINDSHIELD: THEIR GENERATION, SPATIAL LOCALIZATION, AND RECORDING Progress Report, Jan. 1975 - Jan. 1977
Wayne F. Provines, Benjamin Kislin, and Thomas J. Tredici Dec. 1977 20 p refs
(AD-A053470; SAM-TR-77-32) Avail: NTIS HC A02/MF A01 CSCL 01/4

By reviewing basic laws of geometrical optics and applying some fundamentals physiological optics, one can explain the generation and behavior of multiple images in the F/FB-111 windshield. The refinement of windshield optical laboratory techniques yield information for predicting and recording individual windshield multiple image patterns. GRA

N78-28085# Kaman Avidyne, Burlington, Mass.
MEASUREMENTS OF BLAST PRESSURES ON A RIGID 65 DEG SWEPTBACK WING AT MACH 0.76 FROM ROCKET PROPELLED SLED TESTS. VOLUME 1: TEST DOCUMENTATION Final Report, Oct. 1975 - May 1977
J. Ray Ruetenik and Robert F. Smiley 20 Jun. 1977 149 p refs
(Contract DNA001-76-C-0106)
(AD-A053468; AD-E300184; KA-TR-137-Vol-1; DNA-4400F-1) Avail: NTIS HC A07/MF A01 CSCL 19/4

Interaction of a blast wave with a highly sweptback wing model was measured in a series of three sled tests. The sled, traveling at Mach 0.76, was intercepted progressively by blast waves produced from the sequential detonation of three charges of TNT. The model consisted of a sting-mounted wing and fuselage combination. Wing properties were 46.80 in. span, 18.95 in. Mean chord, 2.41 aspect ratio, 0.29 taper ratio, 67 deg. Leading edge sweepback, 64.8 deg. Quarter-chord seeepback, and a 64 A012 wing section. Blast induced loadings were measured at 20 locations on the wing for blast intercept overpressures of about 2 and 4 PSI for blast intercept angles of about 20, 90, and 135 degrees from head-on. A preliminary analysis of the test data indicates the existance of some non-linear blast-induced loads on the model appreciably greater than would be expected on the basis of linearized aerodynamic theory. GRA

N78-28086# Naval Postgraduate School, Monterey, Calif.
COMPUTER STUDIES OF AIRCRAFT FUEL TANK RESPONSE TO BALLISTIC PENETRATORS M.S. Thesis
Richard Alexander Eason Mar. 1978 46 p refs
(AD-A054014) Avail: NTIS HC A03/MF A01 CSCL 01/3

A major goal of the hydraulic ram survivability program for aircraft fuel tanks is the development of an economical computer code which accurately predicts the pressure in the fluid, the response of the tank walls, and the crack damage to the tank due to a ballistic projectile. This study compares the tank wall response predicted by the recently modified SATANS code with the data from studies performed by California Research and Technology, Inc., the Naval Weapons Center, and the University of Dayton Research Institute. Good agreement among the results is obtained for this phase of the study. Additionally, a comparison of the predicted crack length in the entry wall of the tank using Fahrenkrog's criterion and SATANS' predicted circumferential stresses is made with actual crack lengths from a test performed by the University of Dayton Research Institute. The predicted crack lengths were in excellent agreement with the actual crack lengths. Author (GRA)

N78-28087# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.
AIRFOIL DESIGN BY THE METHOD OF SINGULARITIES VIA PARAMETRIC OPTIMIZATION OF GEOMETRICALLY CONSTRAINED LEAST SQUARES OBJECT FUNCTION
T. E. Labrujere 6 Jan. 1978 19 p refs
(NLR-TR-76139-U) Avail: NTIS HC A02/MF A01

A method for the design of airfoils in incompressible flow which, subject to geometrical constraints generates approximately given distribution of the pressure coefficient along the projection of the airfoil chord on an axis parallel to the onset flow is described. The flow is simulated by means of a distribution of singularities along the airfoil contour. The method is based on parametric optimization of a constrained least squares error function. The method results in the determination of the a priori unknown airfoil contour together with the strengths of the singularities. Author (ESA)

N78-28088# Advisory Group for Aerospace Research and Development, Paris (France).
COMBAT DAMAGE TOLERANCE AND REPAIR OF AIRCRAFT STRUCTURES

Jun. 1978 33 p refs Presented at the 46th Struct. and Mater. Panel Meeting, Aalborg, Denmark, Apr. 1978
(AGARD-R-667; ISBN-92-835-1286-3) Avail: NTIS HC A03/MF A01

The following topics are discussed: (1) approaches to combat damage repair; (2) considerations of the likely tolerance to, and repair of battle damage in aircraft structures; and (3) aims and progress of a battle damage repair capability in the Royal Air Force. For individual titles, see N78-28089 through N78-28091.

N78-28089# Army Research and Technology Labs., Fort Eustis, Va. Applied Technology Lab.
APPROACHES TO COMBAT DAMAGE REPAIR
Thomas L. House and John Ariano *In* AGARD Combat Damage Tolerance and Repair of Aircraft Struct. Jun. 1978 p 1-10 ref (For primary document see N78-28088 19-05)
Avail: NTIS HC A03/MF A01

Issues of maintaining helicopters under mid-intensity combat conditions are discussed. The need to defer all but essential scheduled and unscheduled maintenance was addressed with specific interest directed toward minimizing aircraft downtime for combat damage repair. It is apparent that the application of interim, quick-fix approached for certain combat damage repair is needed to achieve an optimum combat maintenance capability. Selected damage repair techniques are discussed, requirements for further development in this area are also reviewed. B.B.

N78-28090# British Aircraft Corp., Warton (England).
SOME CONSIDERATIONS OF THE LIKELY TOLERANCE TO, AND REPAIR OF, BATTLE DAMAGE IN COMBAT AIRCRAFT STRUCTURES
T. Sharples *In* AGARD Combat Damage Tolerance and Repair of Aircraft Struct. Jun. 1978 p 11-24 (For primary document see N78-28088 19-05)
Avail: NTIS HC A03/MF A01

Design cases and likely margins of strength on the major structural components of typical combat aircraft were outlined. Levels of allowable damage which may be expected for both sharp-edged and cleaned out holes caused by projectile damage to structural skins were examined. Simple skin repairs are then discussed followed by a suggested format for a structural Battle Damage Manual. B.B.

N78-28091# Royal Air Force, London (England).
AIMS AND PROGRESS OF A BATTLE DAMAGE REPAIR CAPABILITY IN THE ROYAL AIR FORCE
C. M. Harris *In* AGARD Combat Damage Tolerance and Repair of Aircraft Struct. Jun. 1978 p 25-28 ref (For primary document see N78-28088 19-05)
Avail: NTIS HC A03/MF A01

The background to the RAF's decision to develop a capability to rapidly repair aircraft that were damaged in combat is discussed, and features of aircraft design which would simplify battle damage repair were studied. B.B.

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N78-28092# National Aviation Facilities Experimental Center, Atlantic City, N. J.
HEAD-UP DISPLAYS: A LITERATURE REVIEW AND ANALYSIS WITH AN ANNOTATED BIBLIOGRAPHY Final Report, Oct. 1976 - Sep. 1977
Jack J. Shrager Apr. 1978 132 p
(FAA Proj. 073-320-510)
(AD-A054246; FAA-NA-77-42; FAA-RD-78-31) Avail: NTIS HC A07/MF A01 CSCL 01/4

A bibliographic compilation relating to head-up displays (HUD's) for aircraft cockpit application and a summary of an evaluation of their contents in the areas of human factors, optical techniques, symbology, system concept, safety, simulation and flight test, and other factors or applications are reported. The objective of this in depth literature review is to determine the appropriate follow up course of action in HUD's as it relates to civil aircraft application using current production HUD's. The results of a state of the art HUD analysis which was also performed simultaneously is also summarized. G.Y.

N78-28093# Institute for Defense Analyses, Arlington, Va. Cost Analysis Group.
THE FEASIBILITY OF ESTIMATING AVIONICS SUPPORT COSTS EARLY IN THE ACQUISITION CYCLE. VOLUME 2: APPENDIXES Final Report, 17 Jan. - Sept. 1977
John D. Morgan and Aaron B. Fuller Sep. 1977 251 p refs
(Contract DAHC15-73-C-0200)
(AD-A053486; AD-E500026; P-1292-Vol-2; IDA/HQ-77-19873) Avail: NTIS HC A12/MF A01 CSCL 15/5

This paper reports on research to determine the feasibility of developing methods to estimate, early in the system acquisition cycle, the potential support cost inputs of alternative avionics components envisioned for Air Force and Navy fighter aircraft. Support costs are defined as those costs incurred at the organizational, intermediate and depot levels to maintain avionics equipment and the costs of avionics spares and repair parts support. Volume 2 is a compilation of appendixes containing additional material to support the basic report, including summary evaluations of forty-eight key documents encountered in the literature search. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N78-28094*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
ACOUSTIC TESTS OF DUCT-BURNING TURBOFAN JET NOISE SIMULATION: COMPREHENSIVE DATA REPORT. VOLUME 1, SECTION 1: MODEL SCALE DATA Final Report
P. H. Heck, D. Latham, J. F. Brausch, E. J. Stringas, P. S. Staid, and P. R. Knott Aug. 1978 477 p
(Contract NAS3-18008)
(NASA-CR-135239-Vol-1-Sect-1) Avail: NTIS HC A21/MF A01 CSCL 21E

Model scale data on a 12.2 m (40 ft) arc are presented which were obtained in the hot, static acoustic tests on eleven nozzle designs suitable for use on duct-burning turbofan engines. D.L.G.

N78-28095*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
ACOUSTIC TESTS OF DUCT-BURNING TURBOFAN JET NOISE SIMULATION: COMPREHENSIVE DATA REPORT. VOLUME 1, SECTION 2: FULL SIZE DATA Final Report
P. H. Heck, D. Latham, J. F. Brausch, E. J. Stringas, P. S. Staid, and P. R. Knott Aug. 1978 832 p
(Contract NAS3-18008)
(NASA-CR-135239-Vol-1-Sect-2) Avail: NTIS HC A99/MF A01 CSCL 21E

Acoustic data are presented scaled to a full size engine by a factor of 8 on a 96.9 m (320 ft) arc and a 731.5 m (2400 ft) sideline. D.L.G.

N78-28096*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
ACOUSTIC TESTS OF DUCT-BURNING TURBOFAN JET NOISE SIMULATION: COMPREHENSIVE DATA REPORT. VOLUME 1, SECTION 3: DATA PLOTS Final Report
P. H. Heck, D. Latham, J. F. Brausch, E. J. Stringas, P. S.

Staid, and P. R. Knott Aug. 1978 520 p
(Contract NAS3-18008)
(NASA-CR-135239-Vol-1-Sect-3) Avail: NTIS HC A22/MF A01 CSCL 21E

Acoustic data plots are presented which were obtained in the tests on scale nozzles for use on duct-burning turbofan engines. D.L.G.

N78-28097*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
ACOUSTIC TESTS OF DUCT-BURNING TURBOFAN JET NOISE SIMULATION: COMPREHENSIVE DATA REPORT. VOLUME 2: MODEL DESIGN AND AERODYNAMIC TEST RESULTS Final Report
P. H. Heck, D. Latham, J. F. Brausch, E. J. Stringas, P. S. Staid, and P. R. Knott Aug. 1978 229 p refs
(Contract NAS3-18008)
(NASA-CR-135239-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 21E

The selection procedure is described which was used to arrive at the configurations tested, and the performance characteristics of the test nozzles are given. D.L.G.

N78-28098*# General Applied Science Labs., Inc., Westbury, N. Y.
EXPERIMENTAL STUDY OF THE EFFECT OF CYCLE PRESSURE ON LEAN COMBUSTION EMISSIONS Final Report
Gerald Roffe and K. S. Venkataramani Washington NASA Jul. 1978 51 p
(Contract NAS3-20581)
(NASA-CR-3032; GASL-TR-248) Avail: NTIS HC A04/MF A01 CSCL 21E

Experiments were conducted in which a stream of premixed propane and air was burned under conditions representative of gas turbine operation. Emissions of NOx, CO, and unburned hydrocarbons (UHC) were measured over a range of combustor inlet temperature, pressure, and residence time at equivalence ratios from 0.7 down to the lean stability limit. At an inlet temperature of 600 K, observed NOx levels dropped markedly with decreasing pressure for pressures below 20 atm. The NOx levels are proportional to combustor residence time and formation rates were principally a function of adiabatic flame temperature. For adiabatic flame temperatures of 2050 K and higher, CO reached chemical equilibrium within 2 msec. Unburned hydrocarbon species dropped to a negligible level within 2 msec regardless of inlet temperature, pressure, or equivalence ratio. For a combustor residence time of 2.5 msec, combustion inefficiency became less than 0.01% at an adiabatic flame temperature of 2050 K. The maximum combustion inefficiency observed was on the order of 1% and corresponded to conditions near the lean stability limit. Using a perforated plate flameholder, this limit is well represented by the condition of 1800 K adiabatic flame temperature. Author

N78-28099*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORTRAN PROGRAM FOR CALCULATING COOLANT FLOW AND METAL TEMPERATURES OF A FULL-COVERAGE-FILM-COOLED VANE OR BLADE
Peter L. Meitner (AVRADCOM R and T Labs., Cleveland) Jul. 1978 92 p refs
(NASA-TP-1259; E-9491; AVRADCOM-TR-78-19(PL)) Avail: NTIS HC A05/MF A01 CSCL 21E

A computer program that calculates the coolant flow and the metal temperatures of a full-coverage-film-cooled vane or blade was developed. The analysis was based on compressible, one-dimensional fluid flow and on one-dimensional heat transfer and treats the vane or blade shell as a porous wall. The calculated temperatures are average values for the shell outer-surface area associated with each film-cooling hole row. A thermal-barrier coating may be specified on the shell outer surface, and centrifugal effects can be included for blade calculations. The program is written in FORTRAN 4 and is operational on a UNIVAC 1100/42 computer. The method of analysis, the program input, the program output, and two sample problems are provided. G.G.

N78-28100# Battelle Memorial Inst., Geneva (Switzerland).
THE PROTECTIVE COATING BY ION PLATING OF TURBINE BLADES
21 Apr. 1976 4 p
Avail: NTIS HC A02/MF A01

Ion plating is defined as the deposition on a substrate of a partially ionized vapor obtained in a glow discharge which is formed between the vapor source (anode) and the parts to be coated (cathode) by a negative potential in a low pressure atmosphere of argon (0.01 Torr). The vapor coming from the source is partially ionized in the glow discharge; these ions are drawn by the electric field and hit the parts and condense with a high energy providing a very adherent coating. Due to the pressure, the ions are scattered before condensing and thus the throwing power of the technique is excellent. Sources normally employed are evaporation sources heated by an electron gun. The speed of ion plating can then be very high (up to some micrometer/s). Other sources are also available for specific applications. Author (ESA)

N78-28045 European Space Agency, Paris (France).
AERODYNAMICALLY GENERATED NOISE, ESPECIALLY JET NOISE
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-5 (ESA-TT-459) May 1978 p 1-15 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-5, Sep.-Oct. 1977 p 259-265 Original report in FRENCH previously announced as A78-16618 (For primary document see N78-28044 19-01)
Avail: NTIS HC A06/MF A01

N78-28046 European Space Agency, Paris (France).
FLOW IN A HYDRAULIC MODEL OF AN AXIAL TURBOMACHINE
Henri Werle and Marc Gallon *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-5 (ESA-TT-459) May 1978 p 16-47 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-5, Sep.-Oct. 1977 p 267-288 Original report in FRENCH previously announced as A78-16619 (For primary document see N78-28044 19-01)
Avail: NTIS HC A06/MF A01

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N78-28101*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
USER'S GUIDE FOR A MODULAR FLUTTER ANALYSIS SOFTWARE SYSTEM (FAST VERSION 1.0)
Robert N. Desmarais and Robert M. Bennett May 1978 147 p refs
(NASA-TM-78720) Avail: NTIS HC A07/MF A01 CSCL 01C

The use and operation of a group of computer programs to perform a flutter analysis of a single planar wing are described. This system of programs is called FAST for Flutter Analysis System, and consists of five programs. Each program performs certain portions of a flutter analysis and can be run sequentially as a job step or individually. FAST uses natural vibration modes as input data and performs a conventional V-g type of solution. The unsteady aerodynamics programs in FAST are based on the subsonic kernel function lifting-surface theory although other aerodynamic programs can be used. Application of the programs is illustrated by a sample case of a complete flutter calculation that exercises each program. G.Y.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N78-28102# Army Construction Engineering Research Lab., Champaign, Ill.

RELIABILITY ANALYSIS FOR AIRFIELD LIGHTING SYSTEMS Final Report

E. S. Lindow and F. Kuo Mar. 1978 123 p refs

(Contract DOT-FA66WAI-118)

(AD-A054309; CERL-TR-M-237; FAA-RD-77-148) Avail: NTIS HC A06/MF A01 CSCL 01/5

A model for performing reliability analyses of airfield lighting systems is reported. A set of consecutive coefficients was developed to account for system failure criteria which include random light outages, consecutive light outages, and consecutive light bar failures. Probability theory and simulation techniques are used with the consecutive coefficients to determine system reliability. A computerized version of the model was used in a sensitivity analysis to determine the effect on system reliability of parameters such as unit reliability, system configuration, maintenance strategy, and unit performance characteristics. G.Y.

N78-28103# General Electric Co., Daytona Beach, Fla.

COMPUTER IMAGE GENERATION IMAGERY IMPROVEMENT: CIRCLES, CONTOURS, AND TEXTURE Final Report, Jun. 1976 - Aug. 1977

W. Marvin Bunker and Norman E. Ferris Brooks AFB, Tex. AFHRL Sep. 1977 137 p

(Contract F33615-76-C-0038; AF Proj. 6114)

(AD-A053477; AFHRL-TR-77-66) Avail: NTIS HC A07/MF A01 CSCL 05/9

Computer Image Generation CIG visual simulation systems are now being procured for research and as pilot training simulators. Current systems generate scenes that do not provide sufficient velocity and altitude cues. Training effectiveness would be increased by improving this aspect of the visual scenes. This report covers investigations into three approaches to improving visual scene cues. These are generation of contours ridge-like and valley-like features, generation of circular features, and a ground-map technique for generating surface texture. In each of the three areas, the approach was to develop efficient algorithms, to produce scenes for evaluation of the algorithms and illustration of various methods of using the capability, and to estimate requirements for hardware implementation in real-time systems. A goal in all cases was to minimize the use of the edge-processing capacity of the CIG system. In several cases, scenes were prepared to evaluate the effect of applying different algorithms to achieve a desired result. GRA

N78-28104# McDonnell-Douglas Electronics Co., St. Charles, Mo.

WIDE-ANGLE, MULTIVIEWER INFINITY DISPLAY DESIGN Final Report, Jul. 1976 - Jul. 1977

Robert M. Rhinehart Dec. 1977 82 p refs

(Contract F33615-76-C-0052)

(AD-A053679; AFHRL-TR-77-71) Avail: NTIS HC A05/MF A01 CSCL 05/9

A research design study was undertaken to define an extend field of view (60 x 180) infinity image display, suitable for multiviewer use on wide-bodied aircraft simulators. Mosaicking of single channel units, both reflective and refractive was investigated, along with extended field, off-axis reflective systems. Major emphasis was placed on the investigation of extended field of view, off-axis reflective systems. Various figured screen and mirror combinations, ranging from spherical to high order aspherics, were designed and evaluated. Two specific designs were selected, optimized and evaluated over an extended viewing volume. Author (GRA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N78-28105* National Aeronautics and Space Administration, Washington, D. C.

SECOND VENUS SPACECRAFT SET FOR LAUNCH

27 Jul. 1978 120 p

(NASA-News-Release-78-101; P78-10122) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

The launch phase of the Pioneer Venus Multiprobe spacecraft and cruise phases of both the Pioneer Venus Orbiter and the Multiprobe spacecraft are covered. Material pertinent to the Venus encounter is included. J.M.S.

N78-28106*# Aerospace Corp., El Segundo, Calif. Advanced Orbital Systems Div.

PRELIMINARY DEFINITION AND EVALUATION OF ADVANCED SPACE CONCEPTS. VOLUME 1: EXECUTIVE SUMMARY

I. Bekey 30 Jun. 1978 45 p

(Contract NASw-3030)

(NASA-CR-157300; ATR-78(7674)-1-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22A

A study was made to develop the characteristics, cost, and performance of a few of the more attractive application concepts, and to compare them against leading terrestrial alternatives, in order to determine their potential, identify those deserving further NASA attention and possible inclusion into the formal development planning sequence, and serve to initiate a dialogue with the using community and agencies. L.S.

N78-28107*# Aerospace Corp., El Segundo, Calif. Advanced Orbital Systems Div.

PRELIMINARY DEFINITION AND EVALUATION OF ADVANCED SPACE CONCEPTS. VOLUME 2: ANALYSES AND RESULTS

I. Bekey 30 Jun. 1978 409 p refs

(Contract NASw-3030)

(NASA-CR-157301; ATR-78(7674)-1-Vol-2) Avail: NTIS HC A18/MF A01 CSCL 22A

For abstract, see N78-28106.

N78-28108*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THE DEEP SPACE NETWORK Progress Report, Mar. - Apr. 1978

15 Jun. 1978 312 p refs

(Contract NAS7-100)

(NASA-CR-157310; JPL-DSN-PR-42-45) Avail: NTIS HC A14/MF A01 CSCL 22D

The Deep Space Network progress in flight project support, tracking and data acquisition research and technology, network engineering, hardware and software implementation, and operation is reported. For individual titles, see N78-28109 through N78-28134.

N78-28109*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

NETWORK FUNCTIONS AND FACILITIES **c14**

N. A. Renzetti *In its* The Deep Space Network 15 Jun. 1978 p 1-3 (For primary document see N78-28108 19-12)

Avail: NTIS HC A14/MF A01 CSCL 22D

The objectives, functions, and organization of the Deep Space Network are summarized. Deep space station, ground communication, and network operations control capabilities are described. J.M.S.

N78-28110*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

VIKING EXTENDED MISSION SUPPORT **c15**

R. L. Gillette *In its* The Deep Space Network 15 Jun. 1978 p 4-5 (For primary document see N78-28108 19-12)

Avail: NTIS HC A14/MF A01 CSCL 22D

The Deep Space Network (DSN) support of Viking spacecraft activities and the DSN Viking command and tracking support are reported. The status of DSN Mark 3 data (MDS) subsystem implementation project related Viking testing is included. J.M.S.

N78-28111*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEEP SPACE NETWORK TO VIKING ORBITER TELECOMMUNICATIONS PERFORMANCE DURING THE VIKING EXTENDED MISSION, NOVEMBER 1976 - FEBRUARY 1978 **c32**
F. H. J. Taylor *In its* The Deep Space Network 15 Jun. 1978 p 7-34 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

The telecommunications performance during the Viking extended mission, starting with the completion of the first superior conjunction in November 1976 and ending with the jettison of the VO-2 aft bioshield early in March 1978 is discussed. Viking Orbiter activities and problems, the ground system activities and problems, radio science activities, and communication link performance are included. The substantial involvement of the Deep Space Network and the coordination of their telecommunication planners with Viking Project telecommunications analysts in the planning and execution of complex Viking Orbiter sequences are discussed. J.M.S.

N78-28112*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MISSION SUPPORT **c14**
R. B. Miller *In its* The Deep Space Network 15 Jun. 1978 p 35-38 ref (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

The Tracking and Data System and Deep Space Network preparation and support activities for the Pioneer Venus 1978 Mission are described including prelaunch preparations. The status of multiprobe entry preparations and the differential long base interferometry wind measurement experiment are summarized. J.M.S.

N78-28113*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 DEEP SPACE NETWORK TELECOMMUNICATIONS COMPATIBILITY TEST PROGRAM STATUS **c32**
A. I. Bryan and R. P. Kemp *In its* The Deep Space Network 15 Jun. 1978 p 39-100 (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

The Pioneer Venus 1978 flight project Deep Space Network telecommunications compatibility test program is discussed. Subsystem design tests performed during April 1977 and November 1977 are described. J.M.S.

N78-28114*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT **c14**
P. S. Goodwin, W. N. Jensen, and G. M. Rockwell *In its* The Deep Space Network 15 Jun. 1978 p 101-103 ref (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

Activities of the DSN network operations organization in support of the Helios Project from February 15, 1978 through April 15, 1978 are reported. Mark 3 data subsystems (MDS) testing at the Deep Space Station 2 (Goldstone, Calif.) is included. J.M.S.

N78-28115*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A DEMONSTRATION OF DIFFERENCED DUAL-STATION ONE-WAY DOPPLER CONDUCTED WITH PIONEER 11 **c32**
C. C. Chao, V. J. Ondrasik, and H. L. Siegel *In its* The Deep Space Network 15 Jun. 1978 p 104-110 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

Simultaneous one way Doppler demonstrations performed on Pioneer 11 are described. The data noise of the differenced one way doppler as computed from the pseudo residuals is around 0.002 Hz, which is nearly an order of magnitude smaller than the one way Doppler noise and about the same as differenced two way/three way Doppler noise. The demonstration results and the applicability of differenced one way radio metric data to spacecraft navigation are discussed. J.M.S.

N78-28116*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DELTA VLBI SPACECRAFT TRACKING SYSTEM DEMONSTRATION. PART 1: DESIGN AND PLANNING **c17**
D. L. Brunn, R. A. Preston, S. C. Wu, H. L. Siegel, D. S. Brown, C. S. Christensen, and D. E. Hilt *In its* The Deep Space Network 15 Jun. 1978 p 111-132 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

The current status of planned delta very long base interferometry (VLBI) navigation during Voyager Jupiter encounters is discussed. It is indicated that angular accuracies of 0.05 microrads are possible and that near real time data transmission can be achieved with minimal station hardware and software modifications. A software correlator and phase tracking program, operating on the SFOF IBM 360, used for data processing is described. J.M.S.

N78-28117*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE LOVASZ BOUND AND SOME GENERALIZATIONS **c61**
R. J. McEliece, E. R. Rodemich, and H. C. Rumsey, Jr. *In its* The Deep Space Network 15 Jun. 1978 p 133-146 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 09B

The zero error capacity of a discrete memoryless channel is defined as the largest rate at which information can be transmitted over the channel with zero error probability. One channel with five inputs and outputs whose zero capacity remained unsolved until very recently is considered. An extremely powerful and general technique phased in terms of graph theory, for studying combinatorial packing problems is presented. In particular, Delsarte's linear programming bound for cliques in association schemes appears as a special case of the Lovasz bound. J.M.S.

N78-28118*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ALGORITHM FOR GENERATING AN m-ARY SUMMATION TREE **c61**
M. Sievers *In its* The Deep Space Network 15 Jun. 1978 p 147-151 (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 09B

An algorithm is presented for generating an m-ary summation tree. The algorithm is completely general and may be applied to any length input string. For an N length sequence summed in groups of m sub I at each level I a maximum of 3L - 2 storage is required. A special case of the general m-ary tree where all m sub I are equal is used to smooth data in a radio frequency interference experiment. The maximum storage required when m I sub I = m for all I reduces to the closed form 3 log m N - 2. J.M.S.

N78-28119*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON ESTIMATING THE PHASE OF A PERIODIC WAVEFORM IN ADDITIVE GAUSSIAN NOISE, PART 1 **c32**
L. L. Rauch *In its* The Deep Space Network 15 Jun. 1978 p 152-164 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 20N

Motivated by recent advances in technology, a new look is taken at the problem of estimating the phase of a periodic waveform in additive Gaussian noise. The maximum a posteriori probability criterion with signal space interpretation is used to obtain the structures of optimum and some suboptimum phase estimators for the following cases: (1) known constant frequency and unknown constant phase with an a priori distribution; (2) unknown constant frequency and phase with a joint a priori distribution; (3) frequency a parameterized function of time with a joint a priori distribution on parameters and phase and (4) frequency a Gaussian random process. J.M.S.

N78-28120*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ECONOMIC EVALUATION OF DSS 13 UNATTENDED OPERATIONS DEMONSTRATION **c14**
D. S. Remer (Harvey Mudd Coll.), I. Eisenberger, and G. Lorden *In its* The Deep Space Network 15 Jun. 1978 p 165-171 (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 14B

The goals and data collection requirements to be used for the economic and performance evaluation indexes and life cycle cost parameters for the upcoming operations demonstration of an automated Deep Space Station (DSS) run unattended and controlled remotely from JPL are presented. These evaluation indexes compare the remote operation of telemetry at DSS 13 with the cost and performance of a comparable manned operation

at DSS 11. A description is presented of the data that needs to be collected, how the data will be analyzed, and what can and cannot be learned from this operations demonstration. J.M.S.

N78-28121*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A NEW HYBRID ALGORITHM FOR COMPUTING A FAST DISCRETE FOURIER TRANSFORM **c61**
I. S. Reed (Univ. of S. Calif., Los Angeles) and T. K. Truong *In its* The Deep Space Network 15 Jun. 1978 p 172-185 refs (For primary document see N78-28108 19-12)
(Grant AF-AFOSR-2798-75)
Avail: NTIS HC A14/MF A01 CSCL 09B

For certain long transform lengths, Winograd's algorithm for computing the discrete Fourier transform is extended considerably. This is accomplished by performing the cyclic convolution, required by Winograd's method, with the Mersenne-prime number theoretic transform. This new algorithm requires fewer multiplications than either the standard fast Fourier transform or Winograd's more conventional algorithm. J.M.S.

N78-28122*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VLBI/LASER INTERCOMPARISON PROJECT: SESSION 2 **c36**
H. F. Fliegel *In its* The Deep Space Network 15 Jun. 1978 p 186-189 (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 20E

Recent experiments are described which directly intercompare very long baseline interferometry (VLBI) with laser ranging to artificial satellites by measuring the vector lengths of the same intercontinental baselines. These experiments are part of the VLBI/Laser-Intercomparison Project, a continuing task to assess the suitability of VLBI to various geophysical applications. J.M.S.

N78-28123*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A NEW ALGORITHM FOR COMPUTING PRIMITIVE ELEMENTS IN GF q SQUARE **c61**
I. S. Reed (Univ. of S. Calif., Los Angeles), T. K. Truong, and R. L. Miller *In its* The Deep Space Network 15 Jun. 1978 p 190-196 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 09B

A new method is developed to find primitive elements in the Galois field of sq q elements GF(sqq), where q is a Mersenne prime. Such primitive elements are needed to implement transforms over GF(sq q). J.M.S.

N78-28124*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXAMINATION OF THE DSN X-BAND WEATHER SPECIFICATION **c32**
In its The Deep Space Network 15 Jun. 1978 p 197-208 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

Effects of weather on Deep Space Network system performance at X-band are examined by comparing a record of 64 meter system noise temperatures with weather observations taken at approximately the same times and places. J.M.S.

N78-28125*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIO-FREQUENCY CARRIER ARRAYING FOR HIGH-RATE TELEMETRY RECEPTION **c17**
M. H. Brockman *In its* The Deep Space Network 15 Jun. 1978 p 209-223 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

A method for increasing the sensitivity for radio frequency reception is described. Receiving systems or stations are arrayed in such a manner as to provide signal to noise ratio improvement relative to a single receiving system or station. Radio frequency carrier arraying for high rate telemetry that provides signal to noise ratio improvement for RF carrier reception and demodulation is discussed. J.M.S.

N78-28126*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CCIR PAPER ON THE RADIOCOMMUNICATIONS REQUIREMENTS FOR SYSTEMS TO SEARCH FOR EXTRATERRESTRIAL LIFE **c32**
D. Nightingale *In its* The Deep Space Network 15 Jun. 1978 p 224-244 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

The allocation and propagation of radio frequency bands to be used in the search for extraterrestrial intelligence is considered. Topics discussed include: propagation factors; preferred frequency bands; system characteristics and requirements; and interference. J.M.S.

N78-28127*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF HYDROGEN MASER FREQUENCY DRIFT DUE TO POSSIBLE DRIFTS IN LOAD VSWR AND PHASE ANGLE OF REFLECTION COEFFICIENT **c36**
R. W. Beatty and T. Y. Otosh *In its* The Deep Space Network 15 Jun. 1978 p 245-252 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 20E

Theoretical equations are derived for calculating the effects of local VSWR and reflection coefficient phase angle drifts on hydrogen maser frequency stability. Sample calculations made for a typical JPL maser show that under special load conditions, a VSWR drift of 0.000075/h or phase angle drive of 0.01 deg/h can produce a frequency drift of (10 to the -14th power f sub 0) Hz/h where f sub 0 is the maser frequency of approximately 1.42 x 10 to the 9th power Hz. J.M.S.

N78-28128*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LATERAL FORCES INDUCED BY A MISALIGNED ROLLER **c37**
H. McGinness *In its* The Deep Space Network 15 Jun. 1978 p 253-257 ref (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 20I

The magnitude of the lateral force induced by a roller, misalinged in its direction of travel is considered. Consequences of the induced lateral forces and examples of wheel suspension designs are given. J.M.S.

N78-28129*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STRUCTURAL DESIGN OF A 64-METER LOW-COST ANTENNA **c33**
M. S. Katow *In its* The Deep Space Network 15 Jun. 1978 p 258-275 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 09A

The computer model of a 64 m ground antenna was generated by 1108 software. The reflector and alidade model was iteratively designed and analyzed by the JPL/IDEAS program, which minimized the distortion RMS with respect to the structural weight. Curves of values describing the optimizing processes are presented, functional aspects of the structural elements are defined, and detail descriptions of the design equations for stress calculations are included. Computed data used for calculating the RF boresight error and natural frequency answers are also included. J.M.S.

N78-28130*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CCM IMPLEMENTATION STATUS **c33**
R. A. Mancini *In its* The Deep Space Network 15 Jun. 1978 p 276-281 (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 09C

Activity invested in the preparation of planning the control and computational module (CCM) implementation into the Deep Space Network (DSN) is described. A de facto standard, selection of a standard CCM family, and policies to govern use of CCMs in DSN application are among the topics considered. J.M.S.

N78-28131*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPLEMENTATION OF THE RADIO SCIENCE SUBSYSTEM IN THE DSN **c32**
K. R. Kimball *In its* The Deep Space Network 15 Jun. 1978 p 282-287 (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

The functional characteristics of a subsystem for support of radio science data acquisition requirements are described. The factors that were of major importance in the design and implementation approach are considered. J.M.S.

N78-28132*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ENERGY CONSUMPTION PROGRAM: A COMPUTER MODEL SIMULATING ENERGY LOADS IN BUILDINGS **c44**

F. W. Stoller, F. L. Lansing, V. W. Chai, and S. Higgins *In its* The Deep Space Network 15 Jun. 1978 p 288-289 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 10B

The JPL energy consumption computer program developed as a useful tool in the on-going building modification studies in the DSN energy conservation project is described. The program simulates building heating and cooling loads and computes thermal and electric energy consumption and cost. The accuracy of computations are not sacrificed, however, since the results lie within + or - 10 percent margin compared to those read from energy meters. The program is carefully structured to reduce both user's time and running cost by asking minimum information from the user and reducing many internal time-consuming computational loops. Many unique features were added to handle two-level electronics control rooms not found in any other program. J.M.S.

N78-28133*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK TELEMETRY SYSTEM PERFORMANCE TESTS IN SUPPORT OF THE MARK 3 DATA SYSTEM IMPLEMENTATION **c17**
R. D. Rey and E. J. Nipper *In its* The Deep Space Network 15 Jun. 1978 p 294-301 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 32B

The philocophy and the objectives of the telemetry system performance tests (SPTs) are discussed to demonstrate the benefits gained by performing these tests. The test procedure and test software are included. The results and the status of the Network Telemetry system are summarized. J.M.S.

N78-28134*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN LOAD AND GO PRE-TRACK PREPARATION FOR VOYAGER SUPPORT **c14**
T. M. Taylor *In its* The Deep Space Network 15 Jun. 1978 p 302-305 ref (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

The use of level 4 prepass readiness tests (load and go pretrack preparation) to increase in Network productivity is described. Application of this method of operation for Voyager support, so that increased tracking could be provided to all projects during a period of continued interproject conflicts, is discussed. J.M.S.

N78-28135*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MISSIONS TO COMETS: AN OPTIONS REVIEW
Kenneth L. Atkins Jul. 1978 16 p refs
(Contract NAS7-100)
(NASA-CR-157340; JPL-Pub-78-55) Avail: NTIS HC A02/MF A01 CSCL 22A

The 19 page booklet discusses criteria for selecting candidates for potential comet rendezvous missions and describes possible mission opportunities for the 1985 to 2010 period. Author

N78-28136*# Science Applications, Inc., Huntsville, Ala.
SPACE INDUSTRIALIZATION. VOLUME 1: AN OVERVIEW Final Report
15 Apr. 1978 56 p 4 Vol.
(Contract NAS8-32197)
(NASA-CR-150752; SAI-79-602-HU-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 22A

Benefits accruing to the United States from the investment of public and private resources in space industralization are projected. The future was examined to characterize resource pressures, requirements and supply (population, energy, materials, food). The backdrop of probable events, attitudes, and trends against which space industralization will evolve were postulated. The opportunities for space industry that would benefit earth were compiled and screened against terrestrial alternatives. A cursory market survey was conducted for the selected services and products provided by these initiatives. A.R.H.

N78-28137*# Science Applications, Inc., Huntsville, Ala.
SPACE INDUSTRIALIZATION. VOLUME 2: OPPORTUNITIES, MARKETS AND PROGRAMS Final Report
15 Apr. 1978 335 p 4 Vol.
(Contract NAS8-32197)
(NASA-CR-150753; SAI-79-603-HU-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 22A

The nature of space industrialization and the reasons for its promotion are examined. Increases in space industry activities to be anticipated from 1980 to 2010 are assessed. A variety of future scenarios against which space industrialzation could evolve were developed and the various industrial opportunities that might constitute that evolution were defined. The needs and markets of industry activities were quantitatively and qualitatively assessed and messed. The various hardware requirements vs. time (space industry programs) as space industrialization evolves are derived and analyzed. A.R.H.

N78-28138*# Science Applications, Inc., Huntsville, Ala.
SPACE INDUSTRIALIZATION. VOLUME 3: WORLD AND DOMESTIC IMPLICATIONS Final Report
15 Apr. 1978 146 p 4 Vol.
(Contract NAS8-32197)
(NASA-CR-150754; SAI-79-604-HU-Vol-3) Avail: NTIS HC A07/MF A01 CSCL 22A

The status of worldwide space industralization activities is assessed as well as the benefits to be anticipated from enhanced activities. Methods for stimulating space industralization growth are discussed with emphasis on foreign and international activities, national and world impact assessments, industry/government interfaces, legal implications, institutional implications, economics and capitalization, and implementation issues and recommendations. A.R.H.

N78-28139*# Science Applications, Inc., Huntsville, Ala.
SPACE INDUSTRIALIZATION. VOLUME 4: APPENDICES Final Report
15 Apr. 1978 461 p refs 4 Vol.
(Contract NAS8-32197)
(NASA-CR-150755; SAI-79-605-HU-Vol-4) Avail: NTIS HC A20/MF A01 CSCL 22A

Program development and analysis and recommendations for NASA activities are discussed. The impact of international space law on future use of outer space is examined in the light of applicable international agreements. Recommendations for actions designed to facilitate space industralization are also proposed. A.R.H.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N78-28140 Stanford Univ., Calif.
TECHNO-ECONOMICS OF US DOMESTIC SATELLITE ORBIT-SPECTRUM UTILIZATION Ph.D. Thesis
Steven Paul Russell 1978 240 p
Avail: Univ. Microfilms Order No. 7808837

Procedures were derived to guide the evolution of satellite communications technology for spectrum conservation in order to minimize total user costs. The procedures derived were used to compare different frequency conservation technologies available now or in the near future. Detailed data are presented on available technologies. A computer program was used to evaluate the cost effectiveness of each technology as applied to a number of example satellite systems, and these results are presented. Specific recommendations were made on adoption of current technologies that will make a large impact on orbit spectrum use. Dissert. Abstr.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N78-28141*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
AUTONOMOUS CONTROL OF ROVING VEHICLES FOR UNMANNED EXPLORATION OF THE PLANETS Progress Report, 1 Jun. 1977 - 31 May 1978
S. Yerazunis Jul. 1978 74 p refs
(Grant NsG-7369)
(NASA-CR-157338; RPI-TR-MP-56) Avail: NTIS HC A04/MF A01 CSCL 22B

The guidance of an autonomous rover for unmanned planetary exploration using a short range (0.5 - 3.0 meter) hazard detection system was studied. Experimental data derived from a one laser/one detector system were used in the development of improved algorithms for the guidance of the rover. The new algorithms which account for the dynamic characteristics of the Rensselaer rover can be applied to other rover concepts provided that the rover dynamic parameters are modified appropriately. The new alogirthms will also be applicable to the advanced scanning system. The design of an elevation scanning laser/multisensor hazard detection system was completed. All mechanical and electronic hardware components with the exception of the sensor optics and electronic components were constructed and tested. J.A.M.

N78-28142*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
PROCEDURES FOR THE INTERPRETATION AND USE OF ELEVATION SCANNING LASER/MULTI-SENSOR DATA FOR SHORT RANGE HAZARD DETECTION AND AVOIDANCE FOR AN AUTONOMOUS PLANETARY ROVER
N. Troiani and S. Yerazunis Jul. 1978 107 p refs
(Grant NsG-7369)
(NASA-CR-157337; RPI-TR-MP-57) Avail: NTIS HC A06/MF A01 CSCL 22B

An autonomous roving science vehicle that relies on terrain data acquired by a hierarchy of sensors for navigation was one method of carrying out such a mission. The hierarchy of sensors included a short range sensor with sufficient resolution to detect every possible obstacle and with the ability to make fast and reliable terrain characterizations. A multilaser, multidetector triangulation system was proposed as a short range sensor. The general system was studied to determine its perception capabilities and limitations. A specific rover and low resolution sensor system was then considered. After studying the data obtained, a hazard detection algorithm was developed that accounts for all possible terrains given the sensor resolution. Computer simulation of the rover on various terrains was used to test the entire hazard detection system. J.A.M.

N78-28143*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
WATER IMMERSION FACILITY GENERAL DESCRIPTION, SPACECRAFT DESIGN DIVISION, CREW STATION BRANCH
Feb. 1978 19 p
(NASA-TM-79527; JSC-13808) Avail: NTIS HC A02/MF A01 CSCL 01C

The Water Immersion Facility provides an accurate, safe, neutral buoyancy simulation of zero gravity conditions for development of equipment and procedures, and the training of crews. A detailed description is given of some of the following systems: (1) water tank and support equipment; (2) communications systems; (3) environmental control and liquid cooled garment system (EcS/LCG); (4) closed circuit television system; and (5) medical support system. B.B.

N78-28144# Range Commanders Council, White Sands Missile Range, N. Mex. Documentation Group.
UNIVERSAL DOCUMENTATION SYSTEM HANDBOOK. SUPPLEMENT 1: UNIFORM TEST DATA AND DATA PRODUCT NOMENCLATURE
Apr. 1978 25 p Revised
(AD-A053669; DG-501-70-Suppl-1; DG-501-70-Vol-1-Suppl-1)
Avail: NTIS HC A02/MF A01 CSCL 05/2

The explanations and definitions of terms used for test data and data product nomenclature contained herein have been compiled by the Documentation Group (DG) of the Range Commanders Council (RCC). They are intended as a common reference for the discussion and description of test data between users and ranges, and between ranges. The DG recognizes that it may take some time for these terms to be completely accepted and that there will continue to be minor variances between people and ranges. When known to be applicable, such variances have been pointed out in the text. It is hoped, however, that the universal acceptance of these terms and further improvements in standardization of terminology will significantly improve range interactions. GRA

N78-28145# Societe pour le Perfectionnement des Materiels et Equipements Aerospatiaux, Toulouse (France).
STUDY OF HYDRAULIC GENERATORS FOR VIBRATION TESTS OF LARGE SPACE OBJECTS [ETUDE DES GENERATEURS HYDRAULIQUES POUR LES ESSAIS AUX VIBRATIONS D'OBJETS SPATIAUX DE GRANDES DIMENSIONS]
Merlet and Lemonde Paris ESA 24 Nov. 1977 117 p In FRENCH Report will also be announced as translation (ESA-TT-492)
(Contract ESTEC-3198)
(ESA-CR(P)-1044) Avail: NTIS HC A06/MF A01

Test equipment necessary for future payloads of Ariane and Spacelab is discussed. The state of the art of vibration simulation techniques using hydraulic exciters is presented. Phase 1 of the study deals with the search for high power installations. In phase 2 the available facilities and their limitations are discussed. Phase 3 is concerned with safety systems and with the studies to be undertaken in order to improve existing installations. ESA

N78-28109*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Jun. 1978 p 1-3 (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

N78-28112*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MISSION SUPPORT
R. B. Miller *In its* The Deep Space Network 15 Jun. 1978 p 35-38 ref (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

N78-28114*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT
P. S. Goodwin, W. N. Jensen, and G. M. Rockwell *In its* The Deep Space Network 15 Jun. 1978 p 101-103 ref (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

N78-28120*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ECONOMIC EVALUATION OF DSS 13 UNATTENDED OPERATIONS DEMONSTRATION
D. S. Remer (Harvey Mudd Coll.), I. Eisenberger, and G. Lorden *In its* The Deep Space Network 15 Jun. 1978 p 165-171 (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 14B

N78-28134*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN LOAD AND GO PRE-TRACK PREPARATION FOR VOYAGER SUPPORT
T. M. Taylor *In its* The Deep Space Network 15 Jun. 1978 p 302-305 ref (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N78-28146*# Environmental Research Inst., Moose, Wyo.
ASSESSMENT OF NEEDS FOR SATELLITE TRACKING OF BIRDS AND SUGGESTIONS FOR EXPEDITING A PROGRAM Final Report, Mar. 1976 - Feb. 1978
Frank C. Craighead, Jr. Mar. 1978 81 p refs

(Grant NsG-2157)
(NASA-CR-152168) Avail: NTIS HC A05/MF A01 CSCL 22A

Equipment development and testing, animal-instrument interphase or attachment methods, and the evaluation of various feasibility-tracking experiments with raptors are described as well as suggestions for expediting a future program. Results of animal-instrument interphases work indicate that large free-flying birds can be successfully instrumented with radio packages comparable in weight to satellite-transmitter packages. The 401 MHz frequency proved satisfactory for a combination of satellite and ground tracking of migrating birds. Tests run for nearly a year with the Nimbus 6 satellite and a miniaturized, one-watt prototype RAMS transmitter produced encouraging results in regard to location accuracy, frequency of contact with satellite and use of whip antennas. A future program is recommended with priority given to development of six operational transmitters for feasibility experiments. A.R.H.

N78-28147*# Computer Sciences Corp., Silver Spring, Md.
A RECURSIVELY FORMULATED FIRST-ORDER SEMIANALYTIC ARTIFICIAL SATELLITE THEORY BASED ON THE GENERALIZED METHOD OF AVERAGING. VOLUME 1: THE GENERALIZED METHOD OF AVERAGING APPLIED TO THE ARTIFICIAL SATELLITE PROBLEM
W. D. McClain Nov. 1977 152 p refs 2 Vol.
(Contract NAS5-24300)
(NASA-CR-156782; CSC/TR-77/6010-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 22A

A recursively formulated, first-order, semianalytic artificial satellite theory, based on the generalized method of averaging is presented in two volumes. Volume I comprehensively discusses the theory of the generalized method of averaging applied to the artificial satellite problem. Volume II presents the explicit development in the nonsingular equinoctial elements of the first-order average equations of motion. The recursive algorithms used to evaluate the first-order averaged equations of motion are also presented in Volume II. This semianalytic theory is, in principle, valid for a term of arbitrary degree in the expansion of the third-body disturbing function (nonresonant cases only) and for a term of arbitrary degree and order in the expansion of the nonspherical gravitational potential function. G.Y.

N78-28148*# Computer Sciences Corp., Silver Spring, Md.
A RECURSIVELY FORMULATED FIRST-ORDER SEMIANALYTIC ARTIFICIAL SATELLITE THEORY BASED ON THE GENERALIZED METHOD OF AVERAGING. VOLUME 2: THE EXPLICIT DEVELOPMENT OF THE FIRST-ORDER AVERAGED EQUATIONS OF MOTION AND FOR THE NONSPHERICAL GRAVITATIONAL AND NONRESONANT THIRD-BODY PERTURBATIONS
W. D. McClain May 1978 291 p refs
(Contract NAS5-24300)
(NASA-CR-156783; CSC/TR-78/6001-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 22A

For abstract, see N78-28147.

N78-28149# Committee on Science and Technology (U. S. House).
SOLAR POWER SATELLITE
Washington GPO 1978 461 p refs Hearings before Subcomm. on Space Sci. and Applications and the Subcomm. on Advanced Energy Technologies and Energy Conservation Res., Development and Demonstration of the Comm. on Sci. and Technol., 95th Congr., 2d Sess., No. 68, 12-14 Apr. 1978
(GPO-28-155) Avail: Subcomm. on Space Sci. and Applications

Legislation to establish a program office within the Department of Energy for assigning roles to both NASA and DOE for determining the technical feasibility, economic viability, and social acceptability of satellite solar power transmission to earth is discussed. Cooperation between the two agencies is reviewed and the systems definition efforts being conducted at NASA centers are described by Deputy Administrator, Dr. Alan Lovelace. A.R.H.

N78-28150*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL PERFORMANCE OF GASEOUS-HELIUM-PURGED TANK-MOUNTED MULTILAYER INSULATION SYSTEM DURING GROUND-HOLD AND SPACE-HOLD THERMAL CYCLING AND EXPOSURE TO WATER VAPOR
Irving E. Sumner Aug. 1978 74 p
(NASA-TP-1114; E-9443) Avail: NTIS HC A04/MF A01 CSCL 22B

An experimental investigation was conducted to determine (1) the ground-hold and space-hold thermal performance of a multilayer insulation (MLI) system mounted on a spherical, liquid-hydrogen propellant tank and (2) the degradation to the space-hold thermal performance of the insulation system that resulted from both thermal cycling and exposure to moisture. The propellant tank had a diameter of 1.39 meters (4.57ft). The MLI consisted of two blankets of insulation; each blanket contained 15 double-aluminized Mylar radiation shields separated by double silk net spacers. Nineteen tests simulating basic cryogenic spacecraft thermal (environmental) conditions were conducted. These tests typically included initial helium purge, liquid-hydrogen fill and ground-hold, ascent, space-hold, and repressurization. No significant degradation of the space-hold thermal performance due to thermal cycling was noted. Author

N78-28151# Remtech, Inc., Huntsville, Ala.
REENTRY DESIGN HANDBOOK FOR SOUNDING ROCKET PAYLOADS Final Report, May - Dec. 1977
James V. McAnally, Carl D. Engel, and Judy K. Lapointe Hanscom AFB, Mass. AFGL Dec. 1977 185 p refs
(Contract F19628-77-C-0022)
(AD-A053671; RTR-027-1; AFGL-TR-78-0019) Avail: NTIS HC A09/MF A01 CSCL 22/2

A reentry design handbook has been developed which will assist the sounding rocket payload integration engineer in determining potential reentry dynamics and heating problems in small fineness ratio 2.5 to 7 cylinders and cone-cylinders. Author (GRA)

N78-28152# New Mexico State Univ., Las Cruces.
DEVELOPMENT OF A REAL-TIME ROCKETSONDE AND A REAL-TIME RADIOSONDE COMPUTER PROGRAM
M. Don Merrill and Scott Fry Jan. 1978 142 p
(Contract DAAD07-76-C-0115; DA Proj. 1P6-65702-D-12703)
(AD-A053608; ERADCOM/ASL-CR-78-0115-1) Avail: NTIS HC A07/MF A01 CSCL 04/2

This report contains a detailed description of a computer program that was developed for use with the Interdata 7/32 computer and the interfaced Nike Hercules radar systems located at the MTTR site at White Sands, New Mexico and the Poker Flat site in Alaska. The program can process in real-time a complete data reduction for an MRN rocketsonde or a list of 2 minute layer winds for a radiosonde. For a rocketsonde, the program utilizes the temperature telemetry data, the positional radar data, and the operator inputs of rocketsonde temperature calibration values and base level tie-in data from a radiosonde flight to produce an MRN(WDC-A) format listing of the following: 1 KM corrected and uncorrected winds; Significant level temperature data; 1 KM thermodynamic data; Significant level thermodynamic data; MRN 30 cards (image); Mandatory thermodynamic data; MRN 40 cards (image); and Printer plot of X and Y component winds and temperatures versus 1 KM altitudes. For a radiosonde, the program utilizes the positional radar data to produce a listing of two-minute layer winds at 1 minute intervals. GRA

N78-28153# British Aerospace Dynamics (Space), Stevenage (England).
PRELIMINARY STUDY OF ATTITUDE MEASUREMENT AND CONTROL REQUIREMENTS FOR EARTH RESOURCES SATELLITES. VOLUME 1: SUMMARY Final Report
M. Burton, comp. and J. B. Farrow, comp. Paris ESA Jan. 1978 34 p 3 Vol.
(Contract ESTEC-2864/76-NL-AK(SC))
(TP-7666-Vol-1; ESA-CR(P)-1052-Vol-1) Avail: NTIS HC A03/MF A01

A study in which, quantitatively, total platform attitude and orbital motions, and measurements of total platform motions, were related to the quantity of the remote sensor output is summarized. Topics include remote sensors, output quality criteria

image motion, platform models, attitude sensor models, orbital models modeling and simulation approach, and synthesis tasks. The results of the studies are, between high accuracy attitude control and attitude reconstitution combined with ground-based processing, to achieve a desired quality of output, and, between real-time onboard motion compensation and subsequent data processing, to remove the effects of unwanted motions.
Author (ESA)

N78-28154# British Aerospace Dynamics (Space), Stevenage (England).
PRELIMINARY STUDY OF ATTITUDE MEASUREMENT AND CONTROL REQUIREMENTS FOR EARTH RESOURCES SATELLITES. VOLUME 2: TECHNICAL REPORT Final Report
M. Burton, comp and J. B. Farrow, comp. Paris ESA Jan. 1978 292 p refs 3 Vol.
(Contract ESTEC-2864/76-NL-AK(SC))
(TP-7666-Vol-2; ESA-CR(P)-1052-Vol-2) Avail: NTIS HC A13/MF A01

A study in which, quantitatively, total platform attitude and orbital motions, and measurements of total platform motions, were related to the quality of the remote sensor output is presented. Topics include earth observation satellites, remote sensors, image quality criteria, image motion, attitude sensor models, models of attitude and orbital motion, remote sensor parameters and performance limitations, and specification of attitude control and stabilization requirements. A large simulation was developed which contains detailed models of the platform attitude and orbital motions, the attitude sensors, and the image quality criteria for a number of remote sensors. This simulation was used to derive attitude measurement and control requirements from specifications of remote sensor performance. Author (ESA)

N78-28155# British Aerospace Dynamics (Space), Stevenage (England).
PRELIMINARY STUDY OF ATTITUDE MEASUREMENT AND CONTROL REQUIREMENTS FOR EARTH RESOURCES SATELLITES. VOLUME 3: APPENDICES Final Report
M. Burton, comp. and J. B. Farrow, comp. Paris ESA Jan. 1978 306 p 3 Vol.
(Contract ESTEC-2864/76-NL-AK(SC))
(TP-7666-Vol-3; ESA-CR(P)-1052-Vol-3) Avail: NTIS HC A14/MF A01

Appendices to a study in which, quantitatively, total platform attitude and orbital motions, and measurements of total platform motions related to the quality of the remote sensor output are presented. Topics include remote sensors list, synthetic aperture radar, attitude control and stabilization of limb sounders, image quality from LANDSAT RBV camera, image pre-processing attitude sensor models, use of landmarks to estimate satellite orbital and attitude position, attitude sensor data, mathematical models for scanning remote sensors, image quality criteria for frame imaging remote sensors, and effect of scanner motion on satellite attitude motion. ESA

N78-28156# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON TELECOMMUNICATION POLICY, RESEARCH AND DEVELOPMENT, NO. 47
24 Jul. 1978 47 p refs Transl. into ENGLISH from various world wide journals
(JPRS-71526) Avail: NTIS HC A03/MF A01

Translations from the world press and radio relating to worldwide political, economic, and technical developments in telecommunications, computers, and satellite communications are presented. Coverage is worldwide with focus on France, Federal Republic of Germany, United Kingdom, Italy, Japan, the USSR, Peoples' Republic of China, Sweden, and the Netherlands. For individual title, see N78-28157.

N78-28157# Joint Publications Research Service, Arlington, Va.
OUTLOOK FOR DEVELOPMENT OF SATELLITE COMMUNICATION SYSTEMS
L. M. Aynbinder, L. Kh. Barsegyan, and A. N. Vilshanskiy *In its* Transl. on Telecommun. Policy, Res. and Develop., No. 47 (JPRS-71526) 24 Jul. 1978 p 13-33 refs Transl. into ENGLISH from Radiotekhn. (Moscow), no. 4, Apr. 1978 p 5-19 (For primary document see N78-28156 19-15)
Avail: NTIS HC A03/MF A01

The cardinal advantages of satellite systems over conventional forms of communication is the possibility of worldwide communication over a wide frequency band, and not only with fixed, but with moving objects. The developments in satellite communication to inhance these possibilities are discussed through analysis of the various system components. Major topics of discussion include: (1) methods of increasing the throughput of satellite communication systems, multi-wire antennas, antennas with switching of radiation patterns; (2) satellite antennas, optical systems; (3) multistation access, space time channel separation (STCS); (4) relay units with STCS; and (5) stages of practical realization. G.Y.

N78-28110*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING EXTENDED MISSION SUPPORT
R. L. Gillette *In its* The Deep Space Network 15 Jun. 1978 p 4-5 (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N78-28158*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE POGO PREVENTION
Harold H. Doiron 1977 19 p refs Presented at the Soc. of Automative Engr. Natl. Aerospace Meeting, Los Angeles, 14-17 Nov. 1977
(NASA-TM-79526; JSC-13787) Avail: NTIS HC A02/MF A01 CSCL 22B

A comprehensive plan integrating mathematical model development, stability analysis, verification testing, and pogo suppressor development was implemented to avoid pogo instability in the space shuttle design. Suppressor requirement studies led to selection of gas filled accumulators located at the space shuttle main engine high pressure oxidizer turbopump inlets. These pogo suppressors are currently undergoing development testing before installation for single-engine and clustered engine firings. B.B.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N78-28159*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CARRIER-INTERFERENCE RATIOS FOR FREQUENCY SHARING BETWEEN FREQUENCY-MODULATED AMPLITUDE-MODULATED-VESTIGIAL-SIDEBAND TELEVISION SYSTEMS
Scott P. Barnes and Edward F. Miller Aug. 1978 29 p refs (NASA-TP-1264; E-9478) Avail: NTIS HC A03/MF A01 CSCL 17B

For just perceptible interference, an FM television signal interfering with another FM television signal must have an average signal power that is 26 to 37 db less than the wanted signal power. For an AM-VSB television signal interfering with an FM televivision signal, the AM-VSB television's sync peak average power must be 18 to 31 db below the FM television signal's average power. Also, when an FM television signal interferes

with an AM-VSB signal, the average signal power of the FM signal should be 56 to 59 db below the sync peak average power of the AM-VSB television signal. The range of power ratios occur as a result of different TV scenes used in the tests and different FM-signal frequency deviations used. All tests were performed using 525 line, system M, color-television signals.
G.G.

N78-28116*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DELTA VLBI SPACECRAFT TRACKING SYSTEM DEMONSTRATION. PART 1: DESIGN AND PLANNING
D. L. Brunn, R. A. Preston, S. C. Wu, H. L. Siegel, D. S. Brown, C. S. Christensen, and D. E. Hilt *In its* The Deep Space Network 15 Jun. 1978 p 111-132 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

N78-28125*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIO-FREQUENCY CARRIER ARRAYING FOR HIGH-RATE TELEMETRY RECEPTION
M. H. Brockman *In its* The Deep Space Network 15 Jun. 1978 p 209-223 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

N78-28133*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK TELEMETRY SYSTEM PERFORMANCE TESTS IN SUPPORT OF THE MARK 3 DATA SYSTEM IMPLEMENTATION
R. D. Rey and E. J. Nipper *In its* The Deep Space Network 15 Jun. 1978 p 294-301 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 32B

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-28160*# Sheldahl Co., Northfield, Minn.
PRELIMINARY SOLAR SAIL DESIGN AND FABRICATION ASSESSMENT: SPINNING SAIL BLADE, SQUARE SAIL SHEET Final Report
J. B. Daniels, D. M. Dowdle, D. W. Hahn, E. N. Hildreth, D. R. Lagerquist, El J. Mahaonoul, J. B. Munson, and T. F. Origer Jul. 1977 146 p Revision 1
(Contracts NAS7-100; JPL-954721)
(NASA-CR-157334) Avail: NTIS HC A07/MF A01 CSCL 22B

Blade design aspects most affecting producibility and means of measurement and control of length, scallop, fullness and straightness requirements and tolerances were extensively considered. Alternate designs of the panel seams and edge reinforcing members are believed to offer advantages of seam integrity, producibility, reliability, cost and weight. Approaches to and requirements for highly specialized metalizing methods, processes and equipment were studied and identified. Alternate methods of sail blade fabrication and related special machinery, tooling, fixtures and trade offs were examined. A preferred and recommended approach is also described. Quality control plans, inspection procedures, flow charts and special test equipment associated with the preferred manufacturing method were analyzed and are discussed. B.B.

N78-28161*# Rockwell International Corp., Thousand Oaks, Calif.
STUDY OF CHANGES IN PROPERTIES OF SOLAR SAIL MATERIALS FROM RADIATION EXPOSURE Final Report, 2 Jun. - 29 Nov. 1977
Tennyson Smith Nov. 1977 26 p
(Contract JPL-954776)
(NASA-CR-157324; SC5114.7FR) Avail: NTIS HC A03/MF A01 CSCL 22B

Techniques for monitoring changes in preparation of solar sail materials resulting from space radiation simulation, stressing (e.g., thermal, mechanical) and exposure to terrestrial environments are developed. The properties of interest are: metallic coating deterioration, polymeric film deterioration, interfacial debonding and possible metallic coating diffusion into the polymeric film. Four accelerated tests were devised to simulate the possible degradation processes mentioned above. These four tests are: a thermal shock test to simulate the wide variation of temperature expected in space (260 C to -100 C). a cyclic temperature test to stimulate the 6 minute temperature cycle anticipated in space, a mechanical vibration test to simulate mechanical bonding, folding and handling, and a humidity test to simulate terrestrial environment effects. The techniques for monitoring property changes are: visual and microscopic examination, ellipsometry, surface potential difference (SPD), photoelectron emission (PEE), and water contact angles. G.Y.

N78-28162# Prototype Development Associates, Inc., Santa Ana, Calif.
HARDENED RV DEVELOPMENT PROGRAM. PHASE 3: SAMS/TATER HEATSHIELD/ANTENNA WINDOW FLIGHT TEST PROGRAM Final Report, 3 Nov. 1975 - 30 Sept. 1976
Charles C. Thacker Feb. 1977 64 p refs
(Contract DNA001-76-C-0140)
(AD-A053391; AD-E300162; PDA-TR-1046-02-23; DNA-4369F) Avail: NTIS HC A04/MF A01 CSCL 16/3

The objective of this program was to determine the response of heatshield and antenna window materials in the SAMS/TATER ablation/erosion environment. One clear air and three weather flights were successfully launched during the FY 76 SAMS/TATER Program. Heatshield and antenna windows were recovered from three of the flights and subjected to post-flight analysis. This report describes the materials that were tested, presents post-flight recession measurements and observations, and compares coupled ablation/erosion flight performance with 50 MW ablation only test data. Author (GRA)

N78-28163# RAND Corp., Santa Monica, Calif.
A CRITIQUE OF SPACECRAFT COST MODELS Interim Report
J. A. Dryden and J. P. Large Sep. 1977 87 p refs
(Contract F49620-77-C-0023)
(AD-A053555; RAND/R-2196/1-AF) Avail: NTIS HC A05/MF A01 CSCL 22/2

This paper examines the estimation accuracy of a group of parametric cost models used for a variety of spacecraft. It reinforces the caveat of model builders that models should not be used mechanically but should reflect changing spacecraft characteristics. Weight, the most widely used independent variable, should be less constraining in the next generation of spacecraft with space-shuttle launching. Spacecraft are becoming cheaper on a per-unit-of-performance basis. In estimating nonrecurring costs, none of the models are generally applicable to any subsystem except structure, but several SAMSO models are useful for estimating total nonrecurring cost. All the models do better in estimating recurring costs. The SAMSO models appear most reliable for the user who lacks detailed knowledge of a program and wishes to base an estimate on such characteristics as weight and maximum array output. GRA

N78-28164# British Aircraft Corp. (Operating) Ltd., Bristol (England).
DESIGN STUDY FOR A SPIN-UP AND EJECTION MECHANISM
N. White, J. Watkins, P. Braund, G. Fuller, and G. Arthur Paris ESA Jul. 1977 340 p
(Contract ESTEC-2719/76-NL-PP(SC))
(ESS/SS-747; ESA-CR(P)-1036) Avail: NTIS HC A15/MF A01

The design of a Spacelab spin-up and ejection mechanism (SUEM) is presented The study consisted of phase 1: design trade-off; and phase 2: baseline design. Topics include SUEM specification, component status, assembly, integration, test, and

refurbishment. Basic characteristics are: mass 100 kg (total pallet mounted equipment); length 1.0025 m (1685 m at maximum stroke); diameter(max) 0.35 m (over thermal enclosure); ejection capability 50 to 200 kg at 5 m/s, 200 to 400 kg at 5 down to 3.6 m/s; acceleration (linear) more than 3 g; spin capability 0.1 to 1 rev/s combined with any injection speed; ejection medium dry nitrogen; power (mechanism and control) 50 W max; power (thermal) 30 W max; and crew (one man intermittently over 30 min period). ESA

N78-28165# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany). Hauptabteilung Raumfahrt.
LITERATURE SURVEY OF THE TRADE-OFF BETWEEN SYSTEM TESTING AND INORBIT RELIABILITY OF SPACECRAFT
H. W. vonGuerard and H. G. Maehlert-Berner Paris ESA Feb. 1978 101 p refs
(Contract ESTEC-3291/NL-HP(SC))
(IABG-B-TR-1078/P; ESA-CR(P)-1057) Avail: NTIS HC A06/MF A01

A literature survey of the trade-off between satellite testing and in-orbit reliability based on a computerized literature search on the ESA-Frascati system via the then Munich-based ZLDI terminal is presented. Twenty documents or papers were evaluated in depth; of these, seven documents which appeared of major interest were scrutinized in detail. Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-28166 Colorado State Univ., Fort Collins.
NONLINEAR ANALYSIS OF WAVE DISTORTION RESPONSE Ph.D. Thesis
Yodchai Jotiban 1977 118 p
Avail: Univ. Microfilms Order No. 7807427

A three dimensional analysis of the nonlinear stability of a liquid rocket combustor is presented. The combustor is modeled as a right circular cylinder with arbitrary length to radius ratio, a short nozzle, a concentrated combustion zone with a vaporization dependent response, an acoustic liner of arbitrary length and impedance, and an arbitrary mean flow Mach number. The combustion response model depends on both pressure and transverse velocity perturbations to fractional powers and involves a characteristic time related to a mean or effective droplet lifetime. The oscillations were taken to be more of moderate amplitude. The resulting governing equation and boundary conditions were solved using a Green's function method together with numerical evaluation techniques. Two harmonic components (in time) were considered in the calculations. Results are given in terms of decay rates, frequencies, relative amplitudes and temporal waveforms. Dissert. Abstr.

N78-28167*# Hughes Research Labs., Malibu, Calif.
EXTENDED PERFORMANCE SOLAR ELECTRIC PROPULSION THRUST SYSTEM STUDY. VOLUME 2: BASELINE THRUST SYSTEM Final Report, 14 Feb. 1977 - 29 Aug. 1977
R. L. Poeschel, E. I. Hawthorne et al Sep. 1977 260 p refs Prepared in part by Hughes Aircraft Co.
(Contract NAS3-20395)
(NASA-CR-135281) Avail: NTIS HC A12/MF A01 CSCL 21C

Several thrust system design concepts were evaluated and compared using the specifications of the most advanced 30-cm engineering model thruster as the technology base. Emphasis was placed on relatively high-power missions (60 to 100 kW) such as a Halley's comet rendezvous. The extensions in thruster performance required for the Halley's comet mission were defined and alternative thrust system concepts were designed in sufficient detail for comparing mass, efficiency, reliability, structure, and thermal characteristics. Confirmation testing and analysis of thruster and power-processing components were performed, and the feasibility of satisfying extended performance requirements was verified. A baseline design was selected from the alternatives considered, and the design analysis and documentation were refined. The baseline thrust system design features modular construction, conventional power processing, and a concentractor solar array concept and is designed to interface with the space shuttle. D.L.G.

N78-28168*# Aerojet Liquid Rocket Co., Sacramento, Calif.
PLUG CLUSTER MODULE DEMONSTRATION Final Report, 6 Jun. 1976 - 11 Jun. 1977
D. C. Rousar Jul. 1978 151 p refs
(Contract NAS3-20107)
(NASA-CR-135385) Avail: NTIS HC A08/MF A01 CSCL 21H

The low pressure, film cooled rocket engine design concept developed during two previous ALRC programs was re-evaluated for application as a module for a plug cluster engine capable of performing space shuttle OTV missions. The nominal engine mixture ratio was 5.5 and the engine life requirements were 1200 thermal cycles and 10 hours total operating life. The program consisted of pretest analysis; engine tests, performed using residual components; and posttest analysis. The pretest analysis indicated that operation of the operation of the film cooled engine at O/F = 5.5 was feasible. During the engine tests, steady state wall temperature and performance measurement were obtained over a range of film cooling flow rates, and the durability of the engine was demonstrated by firing the test engine 1220 times at a nominal performance ranging from 430 - 432 seconds. The performance of the test engine was limited by film coolant sleeve damage which had occurred during previous testing. The post-test analyses indicated that the nominal performance level can be increased to 436 seconds. L.S.

N78-28169*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
EXTENDED PERFORMANCE ELECTRIC PROPULSION POWER PROCESSOR DESIGN STUDY. VOLUME 2: TECHNICAL SUMMARY Final Report, 1 May - 25 Oct. 1977
J. J. Biess, L. Y. Inouye, and A. D. Schoenfeld Nov. 1977 156 p
(Contract NAS3-20403)
(NASA-CR-135358; TRW-31526.000-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 21C

Electric propulsion power processor technology has processed during the past decade to the point that it is considered ready for application. Several power processor design concepts were evaluated and compared. Emphasis was placed on a 30 cm ion thruster power processor with a beam power rating supply of 2.2KW to 10KW for the main propulsion power stage. Extension in power processor performance were defined and were designed in sufficient detail to determine efficiency, component weight, part count, reliability and thermal control. A detail design was performed on a microprocessor as the thyristor power processor controller. A reliability analysis was performed to evaluate the effect of the control electronics redesign. Preliminary electrical design, mechanical design and thermal analysis were performed on a 6KW power transformer for the beam supply. Bi-Mod mechanical, structural and thermal control configurations were evaluated for the power processor and preliminary estimates of mechanical weight were determined. B.B.

N78-28170# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
PREDICTION OF COMBUSTION INDUCED VIBRATION IN ROCKET MOTORS Final Report, 1 Mar. 1977 - 28 Feb. 1978
Warren C. Strahle and John C. Handley Apr. 1978 122 p refs
(Contract DASG60-77-C-0054)
(AD-A053586) Avail: NTIS HC A06/MF A01 CSCL 21/8

The source of solid rocket motor vibration is investigated by treating the problem of pressure fluctuations inside the motor cavity. Theoretical aeroacoustics is applied to the cavity gases and imbedded burning metal agglomerates. Several critical experiments are performed to provide numerical input to the theory. Consideration of turbulence, combustion and entropy noise yields the conclusion that only one cause is dominant for the fluctuations in chamber pressure that of interaction of turbulence with the exhaust nozzle. Typically, an 0.4% rms pressure fluctuation can be accounted for by this mechanism. Spectral distributions of the noise are presented and a comparison is made of the theory and an actual motor firing. Author (GRA)

N78-28171# Syracuse Univ., N. Y.
THE EFFECT OF A WIDE EXHAUST PLUME ON THE SCATTERING CURRENT OF A THIN MISSILE
Harvey K. Schuman and Virgil Eveleigh Griffiss AFB, N. Y. RADC Mar. 1978 71 p refs
(Contract F30602-75-C-0121)
(AD-A053598; RADC-TR-78-47) Avail: NTIS HC A04/MF A01 CSCL 21/2

Theoretical predictions of the plane-wave induced uniform-mode scattering current on a typical missile with exhaust plume are presented. An approximate mathematical model is derived based on body-of-revolution theory, the moment method, an impedance-sheet representation and recently achieved plume conductivity profiles. Particular attention is paid to the modification of missile current due to the presence of the plume. This effort supplements recently reported work based on thin-wire modeling of both missile and plume. The significant width of the plume, about eight times the missile diameter, warrants the more sophisticated modeling employed here. Frequencies considered correspond to missile electrical lengths approximately between 0.1 and 1.0 wavelengths. The excitation directions considered are between broadside and 15 degree off missile axis.
Author (GRA)

N78-28172# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
A SIMPLE COMPUTER PROGRAM RAPIB FOR STEADY STATE CALCULATION OF ROCKET PERFORMANCE AND INTERIOR BALLISTICS OF SOLID PROPELLANT ROCKET ENGINES [EEN EENVOUDIG REKENPROGRAMMA VOOR DE STATIONAIRE BEREKENING VAN RAKET PRESTATIES EN INWENDIGE BALLISTIEK VOOR VASTE STUWSTOF RAKET MOTOREN, RAPIB]
F. Bebelaar and H. F. R. Schoeyer Sep. 1977 70 p refs In DUTCH; ENGLISH summary
(VTH-M-285) Avail: NTIS HC A04/MF A01

The RAPIB computer program for rapid performance calculation of solid rocket engines is written in ALGOL 60. Input parameters are grain geometry, propellant characteristics, and nozzle geometry. The program allows solving the steady state algebraic equations that govern the interior ballistics and fluid flow. Flow charts illustrate the main program and the procedures used. In addition, an extensive description is given of the computer program. The theoretical background of the calculations is briefly mentioned. Some results are presented in graphical form.
Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N78-28173*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STABILITY OF CHROMIUM (III) SULFATE IN ATMOSPHERES CONTAINING OXYGEN AND SULFUR
K. T. Jacob (Lawrence Berkeley Lab., Berkeley, Calif.), Bhogeswara D. Rao, and Howard G. Nelson Jul. 1978 21 p refs
(NASA-TM-78504; A-7508) Avail: NTIS HC A02/MF A01 CSCL 07D

The stability of chromium sulfate in the temperature range from 880 K to 1040 K was determined by employing a dynamic gas-solid equilibration technique. The solid chromium sulfate was equilibrated in a gas stream of controlled SO3 potential. Thermogravimetric and differential thermal analyses were used to follow the decomposition of chromium sulfate. X-ray diffraction analysis indicated that the decomposition product was crystalline Cr2O3 and that the mutual solubility between Cr2(SO4)3 and Cr2O3 was negligible. Over the temperature range investigated, the decomposition pressure were significantly high so that chromium sulfate is not expected to form on commercial alloys containing chromium when exposed to gaseous environments containing oxygen and sulfur (such as those encountered in coal gasification). L.S.

N78-28174# Los Alamos Scientific Lab., N. Mex.
PREPARATION OF SYNTHETIC STANDARD MINERALS
C. C. Herrick, S. J. Bustamante, R. W. Charls, R. E. Cowan, E. A. Hakkila, D. E. Hull, B. W. Tolinger, R. B. Roof, H. Heinberg, and G. C. Herrick Jan. 1978 52 p refs Sponsored by DOE
(LA-7072-MS) Avail: NTIS HC A04/MF A01

A number of techniques for synthetic mineral preparations were examined. These techniques include hot pressing in graphite dies at moderate pressures, high pressure, high temperature synthesis in a piston and cylinder apparatus, isostatic pressing under helium gas pressures, hydrous mineral preparations using water as the pressure medium, explosion generated shock waves, and radiofrequency heating. Minerals suitable for equation-of-state studies for thermodynamic property determinations and for microprobe standards were prepared. Mechanical stress-strain calculations in the piston cylinder apparatus were initiated and their integration with thermal stress calculations is currently under investigation. ERA

N78-28175# Brooklyn Coll., N. Y.
PHYSIOCHEMICAL STUDIES OF THE CARBAMATE-CO2-SOLVENT SYSTEM M. S. Thesis
Michael Prencipe Aug. 1977 73 p refs
(Contract EY-76-S-02-3127)
(COO-3127-23) Avail: NTIS HC A04/MF A01

The formation of carbamate from CO2 and the various amine solutions was investigated for the purpose of elucidating the structure of the species generated in the reaction. The amine solutions used were 1 and 2 molar solutions of di-n-butylamine (DNBA) in triethylamine (TEA), pure DNBA and pure TEA. It was found that the nonaqueous solvent participates in the formation of carbamate in 1 and 2M-DNBA/TEA solutions as a proton acceptor in DNBA-carbamate formation. However, due to the high concentration of the solutions and the basicities of the amines, a significant amount of DNBA which does not form the DNBA-carbamate anion is also found to be participating as a proton acceptor. Pure TEA absorbs only 1/60 of the absorption by pure DNBA. The extent of TEA participation in the CO2-absorption process other than as a proton acceptor in DNBA-carbamate is negligible. The formation of carbamic acid and zwitterion have been found unlikely. ERA

24 COMPOSITE MATERIALS

Includes laminates.

N78-28176# British Library Lending Div., Boston Spa (England).
OBTAINING CARBIDE COATINGS ON GRAPHITE
E. F. Anikeev, V. I. Andruyshcenko, and V. I. Kostikov 16 Dec. 1977 11 p Transl. into ENGLISH from Izv. Vyssh. Uc eb. Zaved., Chern. Met. (USSR), 5, 1977 p 145-147
(BLLD-M-25601-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The process of obtaining coatings of titanium and zirconium carbides on graphite were studied. Also, the kinetics and mechanisms of the process of depositing titanium and zirconium from copper-based melts are presented. The controlling stage of the coating growth process is carbon diffusion in the coating obtained. The structure and phase composition of the coatings were investigated. The wetting parameters of the coating obtained by liquid aluminum, copper, silicon and nickel were studied. G.Y.

N78-28177*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PRELIMINARY BURN AND IMPACT TESTS OF HYBRID POLYMERIC COMPOSITES

Stephen S. Tompkins and William D. Brewer Jul. 1978 25 p refs

(NASA-TM-78762) Avail: NTIS HC A02/MF A01 CSCL 11D

Free graphite fibers released into the environment from resin matrix composite components, as a result of fire and/or explosion, pose a potential hazard to electrical equipment. An approach to prevent the fibers from becoming airborne is to use hybrid composite materials which retain the fibers at the burn site. Test results are presented for three hybrid composites that were exposed to a simulation of an aircraft fire and explosion. The hybrid systems consisted of 16 plies of graphite-epoxy with two plies of Kevlar-, S-glass-, or boron-epoxy on each face. Two different test environments were used. In one environment, specimens were heated by convection only, and then impacted by a falling mass. In the other environment, specimens were heated by convection and by radiation, but were not impacted. The convective heat flux was about 100-120 kW/m in both environments and the radiative flux was about 110 kW/sq m. A.R.H.

N78-28178*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

STRUCTURAL WOOD PANELS WITH IMPROVED FIRE RESISTANCE Patent Application

Paul M. Sawko, inventor (to NASA) Filed 28 Jul. 1978 13 p (NASA-Case-ARC-11174-1; US-Patent-Appl-SN-929086) Avail: NTIS HC A02/MF A01 CSCL 11D

Wood paneling or other molded wood compositions are prepared from lignocellulosic particles such as finely divided wood chips, flour, or strands, by bonding such particles with 10 to 33% by weight of a modified novolac resin. The resin prepolymer and a hardening agent such as hexamethylene tetramine are sprayed onto the particles and the mix is hot pressed to form the panel or other article and cure the prepolymer to form the resin. The prepolymer is formed from an alkaryl ether or halide, e.g., 1,4-dimethoxy-methylbenzene, and a phenol. By using the modified resins, panels are formed that have a burn-through time of about 450 seconds as opposed to about 280 seconds, when tested under the same condition. The incorporation of certain inorganic fillers into the prepolymer will decrease the flame spread index of panels in which this is done, from less than 200 to 60 or 70. The preferred fillers are ammonium phosphate or a mixture of that with ammonium oxalate. Such panels, meet Class 2 standards of the Unified Building Code. NASA

N78-28179# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

CHARACTERIZATION OF A NEW COMPOSITE MATERIAL: Fe2O3 IMPREGNATED POLYTETRAFLUOROETHYLENE. 1: PHOTOACOUSTIC SPECTROSCOPY AND PARTICLE-SIZE DETERMINATION

F. Galembeck, C. C. Ghizoni, C. A. Ribeiro, H. Vargas, and L. C. M. Miranda 14 Mar. 1978 20 p refs Submitted for publication

(INPE-1204-PE/115) Avail: NTIS HC A02/MF A01

A first characterization is reported for a new composite material: Fe2O3 - impregnated polytetrafluoroethylene. The samples were prepared by impregnation of the polymer with Fe(CO)5 followed by in situ oxidation of the iron carbonyl. Iron oxide particle size distributions, determined by electron microscopy, were found to be dependent on the oxide concentration in the polymer. The optical absorption spectra were obtained via photoacoustic spectroscopy and the spectral intensities correlated with the particle size distribution and concentration. G.G.

N78-28180# Stanford Univ., Calif. Div. of Applied Mechanics.

APPLICABILITY OF FLOQUET-TYPE SOLUTIONS TO BOUNDED LAYERED COMPOSITES Interim Report

George Herrmann, G. S. Beaupre, and B. A. Auld Feb. 1978 24 p refs

(Contract N00014-76-C-0054; Grant AF-AFOSR-3403-77)

(AD-A053569; SUDAM-78-2) Avail: NTIS HC A02/MF A01 CSCL 11/4

It is shown that certain Floquet-type solutions describing the propagation of horizontally polarized shear waves in an infinite, periodically layered, elastic composite can be considered applicable to composites with boundaries. In particular, this is the case for layered plates with traction-free and rigidly constrained bounding planes, as well as for a layered half-space in which different novel types of surface waves can propagate. Author (GRA)

N78-28181# Stanford Univ., Calif. Div. of Applied Mathematics.

HORIZONTAL SHEAR SURFACE WAVES ON A LAMINATED COMPOSITE Interim Report

B. A. Auld, G. S. Beaupre, and G. Herrmann Feb. 1978 30 p refs

(Contract N00014-76-C-0054)

(AD-A053570; SUDAM-78-3) Avail: NTIS HC A03/MF A01 CSCL 11/4

It is shown that there exists a new class of surface waves with polarization parallel to the surface, like Love waves, that propagates along the free surface of a half-space consisting of a periodically layered composite with layers parallel to the free surface. A method is presented for deriving these horizontally polarized shear wave solutions from plane wave solutions obtained by applying Floquet's Theorem to an infinite periodically layered medium. The different types of surface wave dispersion relations obtained in this way are discussed and the physical significance of two critical points, the conical point and turning point, is noted. Author (GRA)

N78-28182# Sandia Labs., Albuquerque, N. Mex

EFFECT OF WATER-BEARING FIBER IN KEVLAR 49-EPOXY COMPOSITES

Marvin Moss Jan. 1978 14 p refs

(Contract EY-76-C-04-0789)

(SAND-77-0444) Avail: NTIS HC A02/MF A01

Water was observed to be adsorbed, and possibly absorbed, by desiccated Kevlar 49 fiber to 6 percent of the fiber weight in 100 percent relative humidity. The effect of the water on the transverse flexural strength and elastic modulus of an aliphatic amine-cured epoxy, unidirectionally reinforced with saturated Kelvar 49, was determined. Such composites are weaker than those made with fiber equilibrated to 0 percent relative humidity, and the effect persists after a 75 C, 16-h postcure. It is suggested that glycol formation and a consequent excess of curing agent, resulting from a water-resin reaction at the fiber-matric interface, accounts for the weakening. ERA

N78-28183# California Univ., Livermore. Lawrence Livermore Lab.

VARIABILITIES DETECTED BY ACOUSTIC EMISSION FROM FILAMENT-WOUND ARAMID FIBER/EPOXY COMPOSITE PRESSURE VESSELS

Marvin A. Hamstad 30 Nov. 1977 19 p Presented at 24th Intern. Instrumentation Symp., Albuquerque, New Mexico, 1 May 1978

(Contract W-7405-eng-48)

(UCRL-80268; Conf-780503-3) Avail: NTIS HC A02/MF A01

Two hundred and fifty aramid fiber/epoxy pressure vessels were filament-wound over spherical aluminum mandrels under controlled conditions typical for advanced filament-winding. A random set of 30 vessels was proof-tested to 74% of the expected burst pressure; acoustic emission data were obtained during the proof test. A specially designed fixture was used to permit in situ calibration of the acoustic emission system for each vessel by the fracture of a 4 mm length of pencil lead (0.3 mm in

dia) which was in contact with the vessel. Acoustic emission signatures obtained during testing showed larger than expected variabilities in the mechanical damage done during the proof tests. To date, identification of the cause of these variabilities has not been determined. Results demonstrate the wide applicability of acoustic emission for identifying the significant process-control problems in the manufacture of fiber composites. ERA

N78-28184# Maryland Univ., College Park.
NEUTRON DIFFRACTION STUDY OF MAGNETIC ORDER IN THE TERNARY SUPERCONDUCTOR ErMo6Se8
J. W. Lynn, D. E. Moncton (Bell Lab., Murray Hill, New Jersey), G. Shirane (BNL, Upton, N. Y.), W. Thomlinson (BNL, Upton, N. Y.), J. Eckert (BNL,Upton, N. Y.), and R. N. Shelton (Calif. Univ., San Diego) 1977 9 p refs Presented at 23d Conf. on Magnetism and Magnetic Materials, Minneapolis, 8 Nov. 1977 (Contract EY-76-C-02-0016)
(BNL-23450; Conf-771127-10) Avail: NTIS HC A02/MF A01

Powder neutron diffraction data on superconducting (T/sub s/approximately 6 K) samples of ErMo6Se8 taken in the temperature range 0.05 to 2.0 K show that Magnetic Bragg peaks develop at T/sub M/ = 1.1 K, in agreement with specific heat studies. However, it is not possible to index these new reflections using a simple antiferromagnetic unit cell based on the ErMo6Se8 lattice. It is also not possible to index the magnetic reflections based on a single modulation vector, or with a modulation vector along a high symmetry direction including higher order harmonics. Thus, either the long range magnetic order corresponds to a more complicated magnetic structure in the ErMo6Se8 lattice, or at least some of the peaks develop in impurity phases. These results are compared with the recent neutron data on the reentrant superconductors HoMo6S8 and ErRh4B4, in which the development of ferromagnetic order is clearly shown to be responsible for quenching the superconductivity. ERA

N78-28185# Aeronautical Research Inst. of Sweden, Stockholm. Haallfastighetsavdelningen.
USER MANUAL OF THE COMPUTER PROGRAM PS 03 TS. MINIMUM WEIGHT DESIGN OF ORTHOTROPIC SANDWICH PANELS [ANVAENDARANVISNING TILL BERAEKNINGSPROGRAMMET PS 03 TS.]
Lennart Knutsson 1977 27 p refs In SWEDISH; ENGLISH summary
(FFA-HU-2076) Avail: NTIS HC A03/MF A01

The manual covers a time-sharing computer program for minimization of the weight of orthotropic sandwich panels loaded by inplane forces. At given material properties and load cases the program calculates the minimum admissible face thickness with respect to face wrinkling, dimpling, allowable face stresses, and minimum desired stiffness. The program also calculates minimum admissible core thickness to prevent core shear instability. Global buckling is calculated for simply supported panel sides. The minimum weight routine is briefly described and a complete listing of the program is included. The theoretical background of the program is described in references.
Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N78-28186 State Univ. of New York at Buffalo.
VOLTAMMETRIC STUDIES OF POTENTIOSTATIC AND COULOSTATIC MERCURY DEPOSITION USING THE ROTATING RINK-DISK ELECTRODE Ph.D. Thesis
William George Sherwood 1978 256 p
Avail: Univ. Microfilms Order No. 78-10663

A rotating gold disk electrode was used to study the electrochemical behavior of mercury(1) and mercury(2) under both potentiostatic and coulostatic conditions. The potentiostatic oxidation and reduction of Hg(1) produced well developed waves on both gold and platinum in either perchloric or sulfuric acid. Two distinct reduction plateaus were observed for Hg(2) under the same conditions. Dissert. Abstr.

N78-28187 Montana Univ., Missoula.
DEVELOPMENT OF A CONSTANT TEMPERATURE, PLATINUM, ATOMIC ABSORPTION FURNACE AND ITS USE IN POTASSIUM VAPOR PRESSURE MEASUREMENTS FOR MHD Ph.D. Thesis
Bruce Michael Watne 1977 133 p
Avail: Univ. Microfilms Order No. 78-08306

Pyrolytically coated graphite, virtreous carbon, tantalum, tungsten and platinum were tried as heater tube materials in a long path-length, constant temperature, ambient pressure vaporization chamber for flameless atomic absorption. Used in trace elemental analysis, this instrument is commonly known as a Woodriff furnace. Difficulties encountered are described and suggestions for improvement made. Results obtained with pyrolytically coated graphite, vitreous carbon, and platinum heater tubes are compared with those obtained with the graphite heater tubes in the conventional Woodriff furnace. Construction of the platinum furnace is outlined and suggestions for significant improvement are made. Analysis of cadmium standard solutions are shown as a typical analytical application. Dissert. Abstr.

N78-28188 North Carolina Univ. at Chapel Hill.
CHEMICALLY MODIFIED TIN OXIDE ELECTRODES CHARACTERIZED BY CYCLIC VOLTAMMETRY AND ESCA Ph.D. Thesis
Larry Martin Wier 1977 190 p
Avail: Univ. Microfilms Order No. 7810523

Tin oxide electrodes were chemically modified by silanization and following chemical reactions. SnO2/en electrodes prepared with the 3-(2-aminoethylamino) propyltrimethoxysilane were particularly well characterized by a variety of electrochemical and chemical reactivity tests, as well as electron spectroscopy studies. Surface silane coverage can be controlled via reaction conditions; solution species display normal electrochemical activity at silanized, but unpolymerized, tin oxide electrodes. The alkylamine function was derivatized to a dithiocarbamate, which strongly chelates silver ion. Chemisorption of several transition metals on tin oxide electrodes is noted and used to advantage with a RuCl3 (qa.) complex. Dissert. Abstr.

N78-28189 Illinois Univ. at Urbana-Champaign, Urbana.
PART ONE: BINDING AND ACTIVATION OF MOLECULAR OXYGEN BY COBALT COMPLEXES AND PART TWO: BIMETALLOMERS OF VANADYL, COPPER, AND COBALT Ph.D. Thesis
John Allen Breese 1978 260 p
Avail: Univ. Microfilms Order No. 7811213

A thermodynamic study of the enthalpies of base binding to the complex cobalt(II) protoporphyrin IX dimethylester (CoPIXDME) with various bases was conducted. It was found that the enthalpy of base binding was only dependent on the sigma donating ability of the base and therefore could be fit to the E and C correlation. Using the calculated E sub A and C sub A parameters for coPIXDME the enthalpy of base binding to CoPIXDME can be predicted for any base in the E and C correlation. Using the results from a thermodynamic study of dioxygen binding enthalpies to CoPIXDME Base complexes, it was shown that the enthalpy of dioxygen binding increase as the enthalpy of base binding increased. This result was shown to be consistent with a molecular orbital description of the dioxygen interaction with CoPIXDME Base. Dissert. Abstr.

N78-28190 Massachusetts Univ., Amherst.
X-RAY STRUCTURAL ANALYSES AND SPECTROSCOPIC INVESTIGATIONS OF SOME SPIROCYCLIC PHOSPHORANES Ph.D. Thesis
Richard Kenneth Brown 1978 311 p
Avail: Univ. Microfilms Order No. 78-10690

One of the objectives of this work was to determine what chemical and electronic properties stabilize the square pyramidal geometry for five coordinate phosphorus molecules. Spectroscopic studies firmly established the fluxional or stereochemical nonrigid character of many five coordinate molecules. These measurements show the five ligand positions of the trigonal bipyramid are often equivalent on the nmr time scale; indicating an intramolecular exchange process is taking place. It was sought to determine which of the many possible pathways was being followed in the intramolecular exchange observed for many phosphorans and other five coordinate molecules. Comparison with chemically and structurally related compounds were made. A discussion of the chemically important molecular feature for the stabilization is presented. Two methods used to assess the degree of distortion along the Berry coordinate are introduced and applied.
Dissert. Abstr.

N78-28191 Illinois Univ. at Urbana-Champaign, Urbana.
REACTIVITY OF TRANSITION METAL COMPLEXES USING GAS-LIQUID CHROMATOGRAPHY Ph.D. Thesis
Craig Stanley Chamberlain 1978 290 p
Avail: Univ. Microfilms Order No. 78-11217

Gas-liquid chromatographic (glc) methods designed to obtain thermodynamic parameters for 1:1 donor-acceptor reactions were evaluated by comparison of glc results with calorimetric and spectroscopic data. Procedures were developed to determine 1:1 parameters in systems which can potentially form 2:1 adducts and for working with systems in which one of the reactants is gaseous, air sensitive, and/or only available in small quantities. The neat-liquid-on-column method was examined. This method was also used to obtain the enthalpy for gaseous sulfur dioxide/di-n-octyl ether. A modification of the solution-on-column method was also examined. Equilibrium constants and an enthalpy comparable to those obtained by spectrophotometric measurements for the system triethylamine/bis(7,7,11,11 tetramethylheptadecane-8,10 dionato)nickel (2) were obtained with glc.
Dissert. Abstr.

N78-28192 Harvard Univ., Cambridge, Mass.
ELECTROPHORETIC LIGHT SCATTERING OF DILUTE PROTEIN SOLUTIONS Ph.D. Thesis
Daniel Dillon Haas 1978 382 p
Avail: Univ. Microfilms Order No. 7810187

Sample chambers and associated apparatus suitable for measuring the electrophoretic mobilities and diffusion constants by frequency-analysis of scattered laser light are described. Electric field maps and temperature behavior of the solution region in the chamber are calculated. Experimentally obtained spectra of human carboxyhemoglobin display K-dependence of the shifted peak center and K2-dependence of the diffusion-broadened peak width as predicted by theory; additional sources of linewidth broadening are discussed. Predicted and experimentally obtained light-scattering spectra from the electrophoresis of particles caused by a square-wave electric field are presented. The effect of chemical reaction upon electrophoretic lightscattering spectra is calculated. Diffusion studies of human carboxyhemoglobin confirmed the dissociation of the tetrameric form to dimers at high pH.
Dissert. Abstr.

N78-28193 Clemson Univ., S.C.
A STUDY OF THE RELATIONSHIP BETWEEN STRUCTURE AND FLAMMABILITY RETARDATION OF BROMINATED AROMATIC COMPOUNDS ON POLY (ETHYLENE TEREPHTHALATE) Ph.D. Thesis
Virginus Okeawalam Iheyinwa 1977 131 p
Avail: Univ. Microfilms Order No. 78-08590

Derivatives of tetrabromobisphenols A and S were synthesized, incorporated into polyester films and fabrics and their flammability parameters then characterized. The inclusion of the parent bromine compounds and their derivatives in polyester decreased the melting and decomposition temperature of poly(ethylene terephthalate). Thermogravimetric analysis and differential thermal analysis indicate that selected bromine flame retardants exert flame retarding effects predominantly in the vapor phase. Thermogravimetric analysis of both treated and untreated polyester films and fabrics indicate that bromine containing flame retardants can operate in vastly different modes in films and fabrics. The oxygen index values indicate that flame retardants exert higher efficiencies in films than in fabrics.
Dissert. Abstr.

N78-28194 North Carolina Univ., Chapel Hill.
EXPERIMENTS WITH FIELD IONIZATION AND FIELD DESORPTION MASS SPECTROMETRY Ph.D. Thesis
Carl Edward Rechsteiner, Jr. 1977 198 p
Avail: Univ. Microfilms Order No. 78-07159

A number of investigations are described pertinent to the use of Field Ionization and Field Desorption mass spectrometry as an analytical tool. The development of low cost metal field anodes as alternatives to the more common carbon anodes is attractive. An electrodeposition device for routine use in preparing metal emitters is described and the use of such a device to prepare cobalt and ruthenium field anodes is outlined. The possibility of custom design of emitter surfaces for specific functional groups was shown to be a feasible technique using a surface coating of Ag+ ion to selectively ionize alkenes and aromatics in the presence of the alkane analog. The experimental evidence and the corresponding calculations showed that the formation of cluster ions in the Spark Source experiment is totally a vapor phase reaction with the mode of formation being attachment of an alkali ion to a neutral molecule in the vapor phase. Field Deposition data demonstrated that a different process is occurring during formation of cluster ions from alkali halides but the complete mechanism can not be delineated from the present experimental results.
Dissert. Abstr

N78-28195*# Concentration Heat and Momentum, Ltd., London (England).
PREDICTION OF HYDRODYNAMICS AND CHEMISTRY OF CONFINED TURBULENT METHANE-AIR FRAMES IN A TWO CONCENTRIC TUBE COMBUSTOR Contractor Report, May 1977 - Apr. 1978
N. C. Markatos, D. B. Spalding, and S. K. Srivatsa Jul. 1978 290 p refs
(Contract NASw-3077)
(NASA-CR-135412; CHAM-957/2) Avail: NTIS HC A13/MF A01 CSCL 21B

A formulation of the governing partial differential equations for fluid flow and reacting chemical species in a two-concentric-tube combustor is presented. A numerical procedure for the solution of the governing differential equations is described and models for chemical-equilibrium and chemical-kinetics calculations are presented. The chemical-equilibrium model is used to characterize the hydrocarbon reactions. The chemical-kinetics model is used to predict the concentrations of the oxides of nitrogen. The combustor considered consists of two coaxial ducts. Concentric streams of gaseous fuel and air enter the inlet duct at one end; the flow then reverses and flows out through the outer duct. Two sample cases with specified inlet and boundary conditions are considered and the results are discussed. Author

N78-28196# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EFFECT OF THE GRAIN SIZE ON THE PHOTOACOUSTIC SPECTROSCOPY OF POWDERED SAMPLES
Cesar Celeste Ghizoni, Marcus A. A. Siqueira, H. Vargas, and L. C. M. Miranda 18 Jul. 1977 12 p refs Submitted for publication
(INPE-1084-PE/070) Avail: NTIS HC A02/MF A01

The dependence of the photoacoustic signal on the grain size of optically and thermally thick powered samples is discussed. It is shown that as the grain size increases the photoacoustic signal decreases. This effect is interpreted as a consequence of an increase of scattered light as the size increases, resulting therefore in a decrease of the absorbed light.
Author

N78-28197# Wisconsin Univ. - Madison. Materials Science Center.
PHASE TRANSITIONS IN THE CHEMISORBED LAYER W(110) P (2X1)-O AS A FUNCTION OF COVERAGE. I: EXPERIMENTAL
G.-C. Wang, T. M. Lu, and M. G. Lagally 27 Dec. 1977 44 p refs
(Contract N00014-76-C-0727)
(AD-A053454) Avail: NTIS HC A03/MF A01 CSCL 07/4

The thermal disordering of oxygen chemisorbed on W(110)

has been investigated as a function of coverage below half monolayer coverage by measuring the angular distribution of intensity in the LEED superlattice reflections as a function of temperature. The transition temperature is a function of coverage, being much lower at low coverage. A partial phase diagram is constructed for this overlayer, and the low- and high-coverage limits are interpreted respectively in terms of an island-dissolution and an order-disorder transition. Author (GRA)

N78-28198# Wisconsin Univ. - Madison. Materials Science Center.

MONTE-CARLO MODELING OF PHASE CHANGES IN THE CHEMISORPTION SYSTEM O/W (110)

W. Y. Ching, D. L. Huber, M. Fishkis, and M. G. Lagally 16 Dec. 1977 9 p

(Contract N00014-76-C-0727)

(AD-A053453) Avail: NTIS HC A02/MF A01 CSCL 07/4

Monte-Carlo calculations have been made for a number of different models of adatom interactions in the chemisorbed layer W(110)p(2x1)-O to simulate observed phase transitions. In particular the island shape is taken into account. Author (GRA)

N78-28199# Naval Intelligence Support Center, Washington, D. C.

EXPERIMENTAL DETERMINATION OF THE MAGNITUDES OF THE ELEMENTAL MAGNETIC DOMAINS OF NICKEL AND IRON. DIRECTIONAL COAGULATION OF AEROSOLS II (1)

D. Beischer and August Winkel 9 Mar. 1978 9 p refs Transl. into ENGLISH from Die Naturwissenschaft p 420-423

(AD-A053514; NISC-Trans-4005) Avail: NTIS HC A02/MF A01 CSCL 07/4

While the characteristics of dia- and paramagnetism can be explained almost completely from the magnetic properties of the single atoms, the characteristics evident with ferromagnetic materials (size, field dependent value of the permeability, appearance of hysteresis phenomena, and a Curie temperature) can be understood only if the mutually alternating effects between adjacent atoms are considered. There are no 'ferromagnetic' atoms, but ferromagnetic phenomena appear only when there is a multitude of atoms in a particular geometric arrangement. In the classical theory of ferromagnetism, which was developed essentially by P. Weiss, it is assumed that the moments of the individual atoms of small regions (elemental domains) will act together in the same direction because of the mutual relations between the atoms. The moments of the elemental domain that arise in this way though, cancel themselves out by their mutually random directions in a crystal, so that in the absence of an external field it does not show any magnetic moment. GRA

N78-28200# Naval Intelligence Support Center, Washington, D. C. Translation Div.

ABOUT AEROSOLS, WITH EMPHASIS ON THOSE OF IRON OXIDE

Gerhart Jander and August Winkel 9 Mar. 1978 16 p Transl. into ENGLISH from Kolloid-Z (Darmstadt), v. 63, No. 1, 1933 p 5-12

(AD-A053513; NISC-Trans-4004) Avail: NTIS HC A02/MF A01 CSCL 07/2

After a review of the viewpoints which up to now have been predominantly standard, several general characteristics of condensation aerosols were described. After that, the properties of colloidally dispersed iron oxide dust which forms during irradiation of mixtures of a little iron pentacarbonyl vapor and excess air were discussed. The relationship of the mass of individual particles to the concentration and gas pressure of the aerosol system, and in addition the electrical characteristics of aerosols, which were either spontaneously charged or which were given a charge by a physical induction were set forth. Author (GRA)

N78-28201# Colorado State Univ., Fort Collins. Dept. of Chemistry

ABSORPTION AND ELECTRONIC RAMAN SCATTERING SPECTRA OF THE GAMMA SUB 8 g STATE OF IrF6 AT 1.6 MICROMETERS: A RESOLUTION OF THE JAHN-TELLER PROBLEM

E. R. Bernstein and J. D. Webb Mar. 1978 37 p refs

(Contract N00014-75-C-1179; NR Proj. 056-607)

(AD-A053553; TR-17) Avail: NTIS HC A03/MF A01 CSCL 07/4

Electronic Raman scattering and absorption spectra are presented which allow an interpretation of the vibronic structure of the Gamma sub 8g (2T sub 1g) excited electronic state of IrF6 at 1.6 micrometers. Large splittings and shifts are observed for the Jahn-Teller active nu2 (e sub g), nu5 (t sub 2g), and 2nu5 vibrations. From these spectra linear (D2 and D5) and quadratic (Q2(s sub 1g), Q2(e sub g), Q5(a sub 1g), Q5(e sub g), Q5(t sub 2g)) Jahn-Teller parameters can be determined. These data are compared with previously obtained parameters for the ReF6 ground state and the IrF6 Gamma sub 8g (2T sub 2g) at 0.6 micrometers. Author (GRA)

N78-28202# Arizona Univ., Tucson. Dept. of Chemistry.

A SYSTEM FOR GENERATING A FLOWING GAS CONCENTRATION SIGNAL Technical Report, 1 Feb. 1974 - 31 Oct. 1977

J. B. Phillips, D. C. Villalanti, and M. F. Burke 31 Oct. 1977 35 p refs

(Contract N00014-75-C-0512; NR Proj. 051-518)

(AD-A054117; TR-10) Avail: NTIS HC A03/MF A01 CSCL 07/1

The theory, design, and performance of a computer-controlled gas sampling system, utilizing a linear electric motor to pump a liquid metal for the generation of concentration input signals, is presented. Computer control of the current passing through mercury droplets interspaced by gas samples enables control of the amplitude and frequency (1-10 hertz range) of the concentration profile. The system is discussed in terms of the advantages of reproducibility, reliability, and speed resulting from a design with no moving parts. Possible applications in analytical chemistry are numerous, but cross-correlation and other multiple injection chromatographic experiments are of current interest to the authors. Author (GRA)

N78-28203# Johns Hopkins Univ., Baltimore, Md.

STUDY OF THE RADIATION EFFECTS ON NUCLEIC ACIDS AND RELATED COMPOUNDS Progress Report, 15 Aug. 1976 - 14 Nov. 1977

S. Y. Wang Aug. 1977 10 p refs

(Contract EY-76-S-02-3286)

(COO-3286-17) Avail: NTIS HC A02/MF A01

The study was done in vitro. The approach involves four levels of operation: (1) procedures were established to separate and purify three reactive radiation products from thymidine. (2) Improved methods of synthesizing trans-glycols of pyrimidines were developed, and a new method for the stereospecific synthesis of cis-glycol of pyrimidines was realized. (3) The Ames Salmonella test was used to determine the mutagenicity of the radiation products. The reactive ones from thymine and thymidine were found to be highly mutagenic. Therefore, all radiation products should be considered potential human health hazards. (4) The reaction of each nuclei-acid bases with Cu(+2) and cis-5,6-dihydro-6-hydroperoxy-5-hydroxythymine (6-TOOH) was studied to further understand the molecular mechanisms of radiation mutagenesis. The presence of CU(+2) was shown to be necessary for the effective mutagenic activity of 6-TOOH in the H. influenzae transformation assay. These findings will be useful in designing methods to protect against and repair radiation damage, which may be mutagenic and carcinogenic. ERA

N78-28204# Hanford Engineering Development Lab., Richland, Wash.

HIGH-TEMPERATURE OF THERMODYNAMIC PROPERTIES OF SODIUM

A. Padilla, Jr. 1977 91 p refs

(Contract EY-76-C-14-2170)

(HEDL-TME-77-27) Avail: NTIS HC A05/MF A01

The set of high temperature thermodynamic properties for sodium in the two phase and subcooled liquid regions, was modified to incorporate recent experimental data. In particular, replacement of the estimated critical constants with experimentally determined values resulted in substantial differences in the region of the critical point. The following thermodynamic properties were determined: pressure, density, enthalpy, entropy, internal energy, compressibility (adiabatic and isothermal), thermal expansion

coefficient, thermal pressure coefficient, and specific heat (constant-pressure and constant-volume). These properties were determined for the saturated liquid, saturated vapor, subcooled liquid, and superheated vapor. The superheated vapor properties are limited to low pressures and more work is required to extend them to higher pressures. ERA

N78-28205# Atlantic Richfield Hanford Co., Richland, Wash. Production and Waste Management Div.
DETERMINATION OF COMPLEXABLE METALS BY CHELOMETRIC TITRATION
B. H. Nicholson Jun. 1977 22 p refs
(Contract EY-76-C-06-2130)
(ARH-ST-138) Avail: NTIS HC A02/MF A01

A rapid, simple method for the determination of total complexable metal ions Fe(3+), Al(3+), Mn(2+), Ni(2+), Co(2+), Pb(2+), and rare earths in feed to the Hanford strontium recovery process was developed. The method consists of complexing the metal ions with EDTA and titrating the excess with copper (2) ion. Pyrocatechol violet is used as a colorimetric end point indicator. Samples of actual process feed were analyzed and the results compared very favorably with results by atomic absorption. Use of a synthetic feed standard showed an averagy accuracy of 99.7 percent and a relative precision of + or - 95 percent C.L. Interference studies run on the method show that oxalate and phosphate interfere above mole ratios of 0.1 and 0.3, respectively (anion : total complexable cations). Of the complexable metal ions commonly encountered in this feed (specifically excluding alkali and alkaline-earth metals), the only complexable ion not determinable by this method is Cr(3). ERA

N78-28206# Ames Lab., Iowa.
CHEMICAL AND MUTAGENIC ANALYSIS OF WATER SAMPLES
C. D. Chriswell 1978 17 p refs Presented at the Meeting on Environ. Mutagenics, Bethesda, Md., 9 Jan. 1978
(Contract W-7405-eng-82)
(IS-M-126; Conf-780131-1) Avail: NTIS HC A02/MF A01

Resin extraction procedures for separating organic compounds from drinking water are described along with fractionation procedures. Results of testing water samples for mutagenic activity are given. A description of the defense inhibition procedure is included. ERA

N78-28207# California Univ., Livermore. Lawrence Livermore Lab.
ANODIC BEHAVIOR OF CALCIUM IN AQUEOUS SODIUM HYDROXIDE/CHLORIDE: COMPILATION OF EXPERIMENTAL DATA
P. Hosmer and J. Cooper 3 Jan. 1978 81 p refs
(Contract W-7405-eng-48)
(UCID-17740) Avail: NTIS HC A05/MF A01

The investigation of the anodic dissolution of calcium in aqueous solutions of sodium chloride and hydroxide is described. Although calcium passivates in pure hydroxide solutions the addition of the chloride ion induces a stable active state which obeys a linear polarization law with an electrical resistivity of 30 to 300 ohm-sq mm. Open circuit potentials range from -3.1 V for dilute hydroxide/chloride solutions to -1.5 V near the saturation limit. Coulombic efficiency is proportional to the hydroxide concentration, approaching 100 percent near the mutual solubility limit of sodium hydroxide/chloride. On the basis of these efficiencies and polarization studies, for a cathode polarization of 0.4 V at 1 KA/sq m., a calcium-air cell should operate with a 35 to 40 percent thermodynamic efficiency. ERA

N78-28208# Sandia Labs., Albuquerque, N. Mex.
IGNITION CRITERIA FOR NON-PREMIXED STAGNATION POINT FLOW
John G. Taylor and Charles E. Mitchell (Colo. State Univ.) 1978 55 p refs Presented at the Western States Sect./Combust. Inst., Boulder, Colo., 17 Apr. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0389C; Conf-780417-1) Avail: NTIS MF A01

The problem of chemical reaction and ignition in the stagnation point boundary layer of a compressible flow is examined using the finite rate chemical kinetics characteristic of the weak burning region (relatively small Damkohler number) which is typical of the ignition regime in nonpremixed combustion. Reaction is restricted to the gas phase and is modeled as a second order reaction following Arrhenius kinetics. The governing partial differential equations are reduced to ordinary differential equations with the introduction of the Howarth-Dorodnitsyn transformations and numerical solution of these equations is accomplished by application of a generalized parametric differentiation procedure. The method for establishing Damkohler ignition criteria is demonstrated for an acetone-air system and Damkohler ignition numbers are determined for the range of freestream temperatures 661 to 1189 Rankine. In addition, perturbation profiles of temparature, velocity, and fuel and oxidant concentration detailing the behavior of the system in the weak burning region are presented. ERA

N78-28209# Unilever Research, Vlaardingen (Netherlands).
INFRARED SPECTRA OF CHEMISORBED MOLECULES. MAGNETIC AND INFRARED MEASUREMENTS ON METHANE, ETHANE, ETHYLENE AND ACETYLENE ADSORBED ON SILICA-SUPPORTED NICKEL
J. Erkelens and W. J. Woesten [1977] 27 p refs Revised Submitted for publication
Avail: NTIS HC A03/MF A01

Adsorption of acetylene on a silica-supported nickel catalyst, at -20 and 25 C and ethylene at -20 C at a low surface coverage on a bare surface did not give any IR adsorption bands. At a higher coverage, the spectra of adsorbed acetylene and ethylene indicated the presence of surface alkyl groups, which could not be derived from magnetic measurements. No IR spectra were obtained for methane and ethane. Hydrogenation of adsorbed acetylene was studied by magnetic and IR measurements at 25 C. At a low surface coverage, the first portion of the hydrogen that was admitted was chemisorbed; hydrogenation resulted from further additions of hydrogen. Adsorption of acetylene and ethylene was also studied on a hydrogencovered nickel surface. Magnetic measurements indicated a surface reaction accompanied by a decrease in the number of bonds formed between adsorbate and metal surface. Adsorption of acetylene on such a surface gave rise to IR adsorption bands at a low surface concentration; the spectrum did not differ from that obtained with a bare surface. Author (ESA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N78-28210 North Carolina Univ. at Chapel Hill.
THE MAGNETIC PROPERTIES OF SOME LOW-DIMENSIONAL TRANSITION METAL COMPLEXES Ph.D. Thesis
William Edward Estes 1977 439 p
Avail: Univ. Microfilms Order No. 78-10438

Low dimensional magnetic interactions in a variety of dimeric clusters, linear chains, and two dimensional layers are characterized by low temperature susceptibility, isothermal magnetization, or electron paramagnetic resonance. Representative complexes are examined for simple pair interactions (zero-dimensional) in copper (2) halide bridged dimers. A novel correlation between the magnetic and structural properties for the tetragonal pyramidal halo-bridged clusters is proposed. The properties of a unique nitrogen bridged copper (2) dimer are analyzed and discussed. Most examples reveal higher magnetic dimensionalities than structural information would predict. Magnetic chain compounds (one dimensional) are studied. A new class of quasi-two-dimensional ferromagnetic insulators is prepared and characterized in the paramagnetic and ferromagnetic states. Dissert. Abstr.

N78-28211 North Carolina Univ. at Chapel Hill.
THE MAGNETIC PROPERTIES OF COPPER CLUSTER COMPLEXES Ph.D. Thesis
James Walter Hall 1977 300 p
Avail: Univ. Microfilms Order No. 78-10456

Theoretical investigation of the magnetic properties of several spin-1/2 cluster models were made, and the results applied to

the analysis of the data for several copper cluster complexes. The models which were investigated include dimers, trimers, tetramers, linear chains and alternating linear chains. Of particular importance is the generation of theoretical expressions for the magnetic properties of the twenty-five possible structures of tetrametallic clusters. An empirical formula was derived for both linear chain model and alternating linear chain model. A new magnetic standard, (tmen)CuCl4, was studied and used in the calibration of a temperature sensing GaAs diode at high magnetic fields. Of particular importance, from an experimental viewpoint, is the formulation and implementation in this work of the unified Simplex fitting procedure, a general purpose function minimization routine. Dissert. Abstr.

N78-28212 British Library Lending Div., Boston Spa (England).
METAL BONDS WITH EPOXY RESIN AND EPOXY RESIN CASTINGS UNDER LONGTERM EXPOSURE TO DAMAGING EFFECTS
H. Kleinert 4 Nov. 1977 14 p refs Transl. into ENGLISH from Plaste und Kautschuk, 24, 2, 1977 p 130-132
(BLL-DRIC-Trans-5051-(3623.66); BR45881) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Bonded bush/pin joints (material of parts to be joined steel C 15, adhesive epoxy resin Epilox EG 34/hardener 105) were exposed for a period of up to two years to static loads of up to about 3 N/sq mm, to the effects of standard oil 36 and cooling lubricants Emultol B and KC 20 and temperatures up to 70 C, and after the exposure period were tested for residual strength using the compression shear test. The most important finding is that the strengths had not significantly decreased even after two years' exposure. The test results are discussed in detail and additional swell tests carried out on cast resin components and tests with statically loaded bonded joints over a period of up to 30 days at test temperatures up to 200 C are taken into account. G.Y.

N78-28213 British Library Lending Div., Boston Spa (England).
STUDIES OF WHITE LAYERS IN STEELS BY MEANS OF AUGER ELECTRON MICROSCOPY
H. Scheidl, R. Buhl, and F. Jeglitsch 28 Nov. 1977 14 p refs Transl. into ENGLISH from Harterei Tech. Mitt. (Austria), v. 31, no. 5, 1976 p 256-262 Presented at the 20th Conf. on Metals, Mod. Methods of Invest. of Metals, Knowledge and Errors, Arlberg, Austria, 22-25 Apr. 1974
(BLL-RARDE-TR-13/77-(7291.7965)) Avail: British Library Lending Div., Boston Spa, Engl.

The term, white layers, generally indicates those structural zones which occur in hardenable materials following stresses or specific treatment on or immediately under the surface and vary noticeably as against the surrounding matrix according to corrosion of the structure with dilute nitric acid. The incident of these white layers in steels is connected with the formation of martensite and austenite. Martensite and austenite are given specific terms according to their formation. X-ray analysis were performed to explain the causes for the particular behavior of austenite and martensite in various steels. G.Y.

N78-28214 British Library Lending Div., Boston Spa (England).
EFFECT ON MATERIALS OF THERMAL UNION AND SEPARATION
F. Eichhorn 3 Nov. 1977 17 p Transl. into ENGLISH from VDI BER (West Ger.), 1976 p 89-98
(BLL-RARDE-TR-14/77-(7291.7965); FCR/147/416) Avail: British Library Lending Div., Boston Spa, Engl.

During the working of metallic materials to the finished product, the material effects of thermal cutting or joining are of special significance. As a result of the heating effect, not only is the inner structure of the material altered in various ways but simultaneously the induced residual stress also alters the properties of the parts. With welding there is the possibility of further changes in the material composition through various granular materials arising in the melted region as well as through the addition of some additive. Beside grain and stress alterations during the local, thermal preparation, cavities can also arise which may have various pronounced effects on the working qualities of the components. These cavities range from the relatively innocuous, coalescence of gas inclusions arising in the form of micropores to nonmetallic slag inclusions of various shapes, sizes and distributions with lack of bending and the formation of cracks, which interrupt the metallic cohesion over a great area. Because of their pronounced effect, particularly during bending conditions or shock loading, the latter can greatly reduce the carrying capacity and energy absorption of the construction. A.R.H.

N78-28215 British Library Lending Div., Boston Spa (England).
DETERMINING THE FERRITE CONTENT OF AUSTENITIC WELD MATERIALS
H. Spahn et al 2 Sep. 1977 25 p refs Transl. into ENGLISH from TU, vol. 17, no. 12, Dec. 1976 p 406-413
(BLL-CE-Trans-7151-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

In welding austenitic steels a ferromagnetic phase, delta ferrite, appears depending on the alloying composition and on certain welding parameters. Delta ferrite influences many properties of welded austenitic steels, such as: corrosion resistance, ductility, and susceptibility to thermal cracks. Reviewing the effects delta ferrite has on austenitic steels and welds there is no suprise why there is great interest in determining its content. Several methods are discussed for determining delta ferrite concentrations. They include; (1) metallographic determination; (2) radiographic determination; (3) gravimetric method; (4) electrical resistance method; (5) saturation magnetization method; (6) schaeffler or de Long diagram; (7) adhesion force measurement; (8) ballistic flux measurement; and (9) Mossbauer spectroscopy. G.Y.

N78-28216 British Library Lending Div., Boston Spa (England).
PROPERTIES AND CORROSION BEHAVIOR OF VARIOUSLY PRODUCED GALVANIC GLOSS ZINC COATINGS
W. Paatsch and G. Blum Feb. 1978 11 p refs Transl. into ENGLISH from Metalloberflache (West Germany), v. 29, no. 2, 1975 p 59-62
(BLL-RTS-10230) Avail: British Library Lending Div., Boston Spa, Engl.: 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Layers 5, 10 and 20 microns thick were deposited on steel plates from a large number of commercial cyanide, weak cyanide, alkaline cyanide-free and weak acidic gloss zinc electrolytes. Some of the physio-chemical properties of the coating system consisting of the gloss zinc and the steel were determined comparatively. Corrosion tests in artificial climates indicate that layers produced from conventional cyanide baths exhibit a more favorable corrosion behavior than the weak cyanide, alkaline cyanide-free and weakly acidic types of bath in decreasing order. This also seems to apply in equal measure to coatings which are passivated by yellow chromatization. Fully reliable evidence can only be adduced from outdoor weathering tests which are still continuing. G.Y.

N78-28217 British Library Lending Div., Boston Spa (England).
ALUMINUM FOR WORK MATERIALS AND THE ANODIC OXIDATION OF IT. D: THE FORMATION OF THE ANODIC OXIDE FILM ON SHARP CURVES AND EDGES
Max Schenk Feb. 1978 11 p refs Transl. into ENGLISH from the book "Werkstaffe aluminium und seine anodische oxydation: Ein handbuch und ratgeber fuer den praktiker" West Ger, 1948 p 614-619
(BLL-RTS-10924) Avail: British Library Lending Div., Boston Spa, Engl.: 7 BLL overseas, 8 European, or 30 UK BLL photocopy coupons

In the plating industry the capacity of the electrolyte to enable more or less uniformly thick films to form both on elevated spots or deeper ones, or on those further from the anode, is called the throwing power. This throwing power is generally better when the electrolyte is a poorer conductor; but it also depends on other factors (overvoltage, the nature of the deposition, current density, etc.). As a consequence of the concentration of the current at sharp points and edges, more metal is deposited and thickening occurs at the periphery, bulges, spongy deposition, etc. Anodic layers behave quite differently. This behavior of anodic layers due to anodic oxidizing on sharp curves and edges is discussed. G.Y.

N78-28218 British Library Lending Div., Boston Spa (England).
THE RUSTLAYER OF ATMOSPHERIC CORROSION RESISTING STEELS. 4: BEHAVIOUR OF ELECTROLYTE SOLUTIONS IN THE RUST LAYER

Ichiro Suzuki, Noboru Masuko, and Yoshihiro Hisamatsu Jan. 1978 22 p refs Transl. into ENGLISH from Boshoku Gijutsu (Japan), v. 20, no. 7, 1971 p 15-20, and 319-324
(BLL-RTS-11017) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The role of rust in the corrosion resistance of steels in atmospheric exposure environments is studied. Chemical aspects, namely the properties of the electrolyte solution occurring in the rust layer are considered. The behavior of ions in the rust layer is of fundamental importance to analysis of the rust growth process. This paper aims to promote understanding of this problem. G.Y.

N78-28219 British Library Lending Div., Boston Spa (England).
THIN-LAYER GOLD PLATING FOR ELECTRICAL LEADTHROUGHS IN ELECTRONICS: CONSTITUTION AND FINE STRUCTURE
H. Bach and K. H. Mucke Jul. 1978 15 p refs Transl. into ENGLISH from Metalloberflaeche (West Germany), v. 31, no. 7, 1977 p 285-289
(BLL-RTS-11031) Avail: British Library Lending Div., Boston Spa, Engl.

In the gold plating of electrical leads employed in the construction of semiconductor structural elements, the customary gold deposit thicknesses of 1-2 micron can only be decreased to 0.5-1 micron if the gold deposits satisfy increased requirements as regards porosity, structure and metallic and organic impurities. These deposits must be virtually free from pores due to surface defects in the parent material (roughness, oxides, adhering organic and inorganic particles) or the crystal structure of the gold deposit (voids between the individual crystallites). They must be macroscopically plane, and have a microscopically smooth surface structure and minimum grain boundary areas. The gold deposits should also be largely free from metallic impurities and carbon inclusions. G.Y.

N78-28220# British Library Lending Div., Boston Spa (England).
THERMODYNAMIC PROPERTIES OF Ni - Si - C ALLOYS
V. A. Rudenko and V. P. Aseev 16 Dec. 1977 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), 4, 1977 p 9-12
(BLLD-M-25590-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The solubility of carbon in Ni-Si-C alloys is studied. The concentration activity function of silicon in carbon saturated Ni-Si-C alloys was determined for the 1700-2100 K temperature range and the calorimetric method was used to measure the partial molar enthalpies of the silicon and nickel in carbon saturated Ni-Si-C alloys at 10900 K. The relationship between the concentrations and relative integral molar enthalphy carbon saturated nickel-silicon alloys is determined. G.Y.

N78-28221# British Library Lending Div., Boston Spa (England).
SOLUBILITY OF TITANIUM AND NITROGEN IN THE Fe-Ni SYSTEM
N. R. Frage and Yu. Gurevich 16 Jan. 1978 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), 6, 1977 p 5-6
(BLLD-M-25614-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

A thermodynamic analysis is made of the titanium nitrides formation condition in Fe-Ni-Ti melts with due regard to the asymmetry of their properties in the Fe-Ni system. The titanium nitrides formation conditions deteriorate with increase in the nickel content of the melt, this being due to a strengthening of the titanium bonds in the melt. The formation of titanium nitrides in the molten metal is highly improbable for normal titanium and nitrogen contents. Nonmetallic inclusions formed during solidification of the ingot may dissociate during remelting processes. Calculations demonstrate that 15 to 5 micron inclusions will completely dissolve on the skin of the consumable electrode. The final nitrogen content of the metal after remelting is evidently governed by the nitrogen permeability of the slag. Author

N78-28222# British Library Lending Div., Boston Spa (England).
ROLE OF VOLUME AND INTERGRANULAR DIFFUSION PHENOMENA IN THE OXIDATION OF A Ni-Cr 80/20 ALLOY BETWEEN 800 AND 1300 DEG C
P. Moulin, A. M. Huntz, G. Beranger, and P. Lacombe 16 Jan. 1978 8 p refs Transl. into ENGLISH from Scr. Met., v. 11, 1977 p 533-537
(BLLD-CE-Trans-7261-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Various investigations of the oxidation in pure oxygen of Ni-Cr 80/20 alloys show that in an initial stage the oxide Cr2O3 develops directly above the grain boundaries of the alloy, whereas the oxide NiO grows at the grains. A comparative study was made of the volume and intergranular diffusions of the Cr and Ni in this alloy. The diffusion studies were carried out on specimens taken from the a samecasting as those used in the oxidation investigation. The temperature range studied (800-1300 C) corresponded to that used in the oxidation study. The generalized Gruzin method was used to calculate the volume diffusion coefficients. Suzuoka's analysis was used to evaluate the product of the intergranular diffusion coefficient and the apparent width of the grain boundary. G.Y.

N78-28223 Northwestern Univ., Evanston, Ill.
THE EFFECT OF MICROSTRUCTURE AND CARBON CONTENT ON THE FATIGUE CRACK GROWTH RATE IN IRON-CARBON ALLOYS Ph.D. Thesis
Carolyn Rubin Aita 1977 136 p
Avail: Univ. Microfilms Order No. 78-05240

Fatigue crack growth rate data was obtained at room temperature for nine Fe-C alloys whose carbon content ranged from 0.23 to 1.08 weight percent carbon. Two types of microstructures were considered: ferrite/coarse pearlite and ferrite/iron carbide particles of spheroidal and lenticular shape. It was found that when the mode of fatigue crack propagation was predominantly ductile and that when plastic deformation was confined to a small region ahead of the crack tip, fatigue crack growth rate could be described by an equation of the form da/dN = C(Delta K) to the m power. When transgranular slip was the predominant mode of crack propagation, m congruent to 4. The crack growth rate for hypereutectoid alloys containing iron carbide particles embedded in a ferrite matrix was almost an order of magnitude greater than the crack growth rate for hypoeutectoid alloys of similar microstructures.
Dissert. Abstr.

N78-28224 Texas Univ., Austin.
COARSENING OF STEEL IN A TEMPERATURE GRADIENT Ph.D. Thesis
Thomas Clifton Shelton 1977 74 p
Avail: Univ. Microfilms Order No. 78-07386

The effect of a temperature gradient on the microstructure of a 1080 steel was studied for the cases where the initial microstructure had a spheroidized and a pearlitic form. A temperature gradient of approximately 200 C/cm and an annealing time of 96 hr were used and isothermal anneals were carried out for several times and temperatures. The surface area per unit volume was measured along several isotherms in the case of the gradient samples and for the isothermal specimens. The results were then plotted versus square root of Dt for comparison of the isothermal and gradient results. The following conclusions were made: (1) the gradient significantly reduced the rate of coarsening of the microstructure in both cases, and (2) based on the results for a 1080 steel and earlier results obtained for a 1040 steel, there is no significant measurable redistribution of the second phase for the times and temperatures employed.
Dissert. Abstr.

N78-28225*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EROSION /CORROSION OF TURBINE AIRFOIL MATERIALS IN THE HIGH-VELOCITY EFFLUENT OF A PRESSURIZED FLUIDIZED COAL COMBUSTOR
Glenn R. Zellars, Anne P. Rowe, and Carl E. Lowell Jul. 1978 33 p refs
(NASA-TP-1274; E-9507) Avail: NTIS HC A03/MF A01 CSCL 11F

Four candidate turbine airfoil superalloys were exposed to the effluent of a pressurized fluidized bed with a solids loading of 2 to 4 g/scm for up to 100 hours at two gas velocities, 150 and 270 m/sec, and two temperatures, 730 deg and

795 C. Under these conditions, both erosion and corrosion occurred. The damaged specimens were examined by cross-section measurements, scanning electron and light microscopy, and X-ray analysis to evaluate the effects of temperature, velocity, particle loading, and alloy material. Results indicate that for a given solids loading the extent of erosion is primarily dependent on gas velocity. Corrosion occurred only at the higher temperature. There was little difference in the erosion/corrosion damage to the four alloys tested under these severe conditions. G.G.

N78-28226*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LOW TOXIC CORROSION INHIBITORS FOR ALUMINUM IN FRESH WATER
T. S. Humphries Jul. 1978 17 p
(NASA-TP-1279; M-259) Avail: NTIS HC A02/MF A01 CSCL 11F

Combinations of chemical compounds that reportedly reduce the corrosion of aluminum in fresh water were evaluated. These included combinations of borates, nitrates, nitrites, phosphates, silicates, and mercaptobenzothiazole. Eight of fifty inhibitor combinations evaluated gave excellent corrosion protection and compared favorably with sodium chromate, which has generally been considered standard for many years. Author

N78-28227# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
WELDABILITY AND BRAZEABILITY OF FORMABLE SHEET TITANIUM ALLOYS Final Report, Jun. 1970 - Dec. 1976
Donald W. Becker Sep. 1977 45 p refs
(AD-A053589; AFML-TR-77-165) Avail: NTIS HC A03/MF A01 CSCL 11/6

Three metastable beta titanium alloys were evaluated for their weldability and brazeability. The alloys were Ti-8V-7Cr-3Al-4Sn-1Zr, Ti-8V-4Cr-2Mo-2Fe-3Al, and Ti-15V-3Cr-3Al-3Sn. The material evaluated was in the form of .100 inch sheet and was processed by hot rolling and also hot plus cold rolling. The weldability was evaluated by longitudinal bead on plate weld tensile specimens. Lap shear tensiles prepared with A13003 filler metal were used to determine the braze strength. The rating for the alloys according to weldability and in order of performance was determined to be Ti-8V-7Cr-3Al-4Sn-1Zr, Ti-15V-3Cr-3Al-3Sn, and Ti-8V-4Cr-2Mo-2Fe-3Al. Normal brazing practice was found to be acceptable for all three titanium alloys.
Author (GRA)

N78-28228# Naval Civil Engineering Lab., Port Hueneme, Calif.
PROTECTIVE COATINGS FOR STEEL PILING: ADDITIONAL DATA ON HARBOR EXPOSURE OF TEN-FOOT SIMULATED PILING Final Report, Sep. 1969 - Sep. 1975
Robert L. Alumbaugh and A. F. Curry Mar. 1978 105 p Supplement to NCEL-TR-711, AD-881761
(AD-A053504; CEL-TR-711S) Avail: NTIS HC A06/MF A01 CSCL 11/3

This final report, supplement to CEL Technical Report TR-711, presents additional results of the investigation of protective coating systems of various generic types that were applied to 10-foot steel panels. These simulated steel pilings were suspended from a corrosion dock in the mouth of Port Hueneme Harbor so that the bottom portion was in continuous immersion, the middle portion in the tidal zone, and the top portion in the atmosphere. Results are given for coating systems that were performing satisfactorily at the time TR-711 was issued. Exposure times for the 85 coating systems suspended from the corrosion dock ranged from 9 to 21-1/2 years. Author (GRA)

N78-28229# Oak Ridge Y-12 Plant, Tenn. Metallurgy Dept.
STUDY OF VARIABLE ELONGATIONS IN THE URANIUM-0.75 WEIGHT PERCENT TITANIUM ALLOY
T. G. Kollie Nov. 1977 22 p refs
(Contract W-7405-eng-26)
(Y-DA-7421) Avail: NTIS HC A02/MF A01

Tensile specimens cut from the same gamma-quenched-and-aged, 32 mm-thick plate of U-0.75 wt percent Ti alloy exhibited elongations that varied between 9.4 and 17.2 percent. Results of microhardness, electron microprobe, chemical analysis, scanning electron microscopy, transmission electron microscopy, ion microprobe analysis, optical microscopy, heat-transfer calculations, and quenching-rate studies led to the conclusion that the variable ductilities were caused by quenching rates from the gamma phase that were too slow and were different across the thickness of the plate. Work of others is cited to support this conclusion. Two solutions to the problem are suggested: (1) add a third element to the alloy to slowdown the gamma = alpha + U2Ti transformation so that titanium is retained in solution in the martensitic a'phase, or (2) substantially improve the heat-transfer coefficients in the quenching bath. The latter suggestion is the near-term solution, whereas the former suggestion is the long-range and better solution. ERA

N78-28230# Oak Ridge National Lab., Tenn.
PRECIPITATION RESPONSE OF AUSTENITIC STAINLESS STEEL TO SIMULATED FUSION IRRADIATION
P. J. Maziasz 1978 34 p refs Presented at 107th AIME Meeting, Denver, Colo., 26 Feb. 1978
(Contract W-7405-eng-26)
(CONF-780213-2) Avail: NTIS HC A03/MF A01

The precipitation response of annealed type 316 stainless steel irradiated in HFIR were studied and compared to previously observed thermal aging and fast reactor irradiation responses. Irradiation in HFIR simultaneously produces high levels of helium and displacement damage and partially simulates a fusion environment. Samples were irradiated at temperatures from 550 to 680 C to fluences producing up to 3300 appm He and 47 dpa. ERA

N78-28231# Instituto Nacional de Tecnica Aeroespacial, Esteban Terradas, Torrejon de Ardoz (Spain).
APPLICATION OF THERMAL ANALYSIS TO THE STUDY OF TRANSFORMATIONS IN ALUMINUM ALLOYS [APLICACION DE LAS TECNICAS DE ANALISIS TERMICO AL ESTUDIO DE TRANSFORMACIONES EN LAS ALEACIONES DE ALUMINIO]
J. A. GarciaPoggio, P. TarinRemohi, A. AlonsoRoldan, and J. M. BadiaPerez 1977 17 p In SPANISH Presented at the 4th Gen. Meeting of the Centro Nacl. de Invest. Met. (CENIM), Madrid, May-Jun. 1977
Avail: NTIS HC A02/MF A01

Some applications of differential thermal analysis to aluminum alloys were studied. The fusion process, the formation of constituents during solidification, eutectic reactions, and hardening processes were investigated in particular. The differential thermal analysis method was found to be quite suitable to the study of structure transformations in aluminum alloys. ESA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N78-28232 North Carolina Univ. at Chapel Hill.
THE EFFECT OF LIQUID INERTIA ON THE INTRINSIC VISCOSITY OF RIGID ROD-LIKE MACROMOLECULES Ph.D. Thesis
Robert Thomas Foister 1977 116 p
Avail: Univ. Microfilms Order No. 7810441

The contribution of suspended macromolecular particles to the viscosity of the suspension can be formulated in terms of the frictional force exerted by these particles on the liquid. Simple models of rigid rod-like macromolecules were used to investigate the effect of additional non-steady terms in the frictional force on the viscosity contribution. On the basis of approximate evaluations it was determined that liquid inertia acts to reduce substantially the total force exerted by rod-like particles on the liquid. Corresponding reductions in total intrinsic viscosity can be as large as twenty-five to fifty percent depending upon the type of boundary conditions at the particle surface.
Dissert. Abstr.

N78-28233 British Library Lending Div., Boston Spa (England).
STUDY OF CURING OF EPOXY RESINS
K. E. Luettgert and R. Bonart 2 Sep. 1977 16 p refs Transl. into ENGLISH from Colloid and Polymer Sci., vol. 254, 1976 p 310-318

(BLL-CE-Trans-7122-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Samples of a thermosetting resin hardener system (araldite F/HY905) were subjected to various nondestructive tests to determine the degree of hardening. The direct physical method, using IR spectroscopy, proved unsatisfactory because the instrument recorded no measurable oxirane group extinction long before the end of the cure was reached. Differential scanning calorimeter tests provided several data simultaneously: (1) exothermal residual reaction enthalpy indicated whether and to what extent residual reactions were still possible; (2) the glass temperature showed up as a definite step from the temperature level so that conclusions could be drawn as to the degree of cure; and (3) superimposed on the glass temperature was an endothermal peak whose position and amplitude permitted conclusions regarding the aging of the specimen. Dilatometry, using a thermal mechanical analyzer, provided expansion coefficients and indicated internal stress and glass temperature as a function of the degree of cure. Cure times up to complete curing determined by these methods are in agreement with those required for maximum bending strength. A.R.H.

N78-28234 British Library Lending Div., Boston Spa (England).
THE ASSESSMENT OF POLYMER MATERIAL FLAMMABILITY BY THE LIMITED OXYGEN INDEX TEST. 1: THE EFFECT OF DIMENSIONS OF EXPERIMENTAL SAMPLES ON THE MEASUREMENT RESULTS
Pavel Smilek 2 Sep. 1977 7 p refs Transl. into ENGLISH from Plasty a Kaucuk (Czech.), no. 9, 1976 p 264-267
(BLL-Trans-3466-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

Current standards of the limited oxygen index or standards being discussed recommend experimental samples in the form of bars, films and tin plates, and materials formed into prisms and containing light density fillers. A problem arises if results obtained from testing identical materials made into differently shaped samples are compared. Linear and branched samples of polyethylene, polypropylene, and polyvinylchloride were testing using experimental method CSN 64 0756. The difference in the shape and size of the experimental samples recommended for the test do not significantly influence test progress or test results. The value of the limited oxygen index is practically constant after the sample thickness exceeded 2 mm. A.R.H.

N78-28235 British Library Lending Div., Boston Spa (England).
INFLUENCE OF TEMPERATURE ON PHOTO-OXIDATION OF PLASTICS
Pavel Svoboda and Libuse Rektorikova 23 Aug. 1977 7 p refs Transl. into ENGLISH from Plasty Kaucuk (Czech), no. 10, 1976 p 302-304 Presented at the 9th Conf. of Danubian Countries, Gottwaldov, Czech., Sep. 1976
(BLL-PO-Trans-3518-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

Results of experiments are given, which verified the validity of a proposed mathematical model of polymer degradation by light radiation and by temperature. Based on these results, certain conclusions were arrived at, which are relevant to forecasting service life of plastics under atmospheric conditions. J.A.M.

N78-28236 British Library Lending Div., Boston Spa (England).
FIRE RESISTING PROPERTIES OF PLASTIC MATERIALS
P. Prager 22 Nov. 1977 25 p refs Transl. into ENGLISH from Plastiques Mod. et Elastomeres (France), no. 3, Apr. 1975 p 99-103 and 112-113
(BLL-Trans-3532-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

The criteria relating to ignition are considered most significant in determining the fire resistance properties of materials. The fundamental characteristic factors which combine to determine these properties and the main factors influencing them are examined. Fire resistant ratings used in Germany, Belgium, the Netherlands, Denmark, and the United Kingdom are presented for 24 plastic or composite materials. Combustion tests methods and evaluation criteria are examined as well as test principles for evaluating hazards used in Switzerland. The relative toxicity of combustion products from plastic or composite building materials is discussed as well as toxicity from slow combustion and the damage caused by corrosive gases. A.R.H.

N78-28237 British Library Lending Div., Boston Spa (England).
THE THERMAL DEGRADATION OF PVC
R. A. Panko and V. S. Pudov 8 Nov. 1977 12 p refs Transl. into ENGLISH from Vysokomol. Soedin. (USSR), v. 16, no. 6, 1976 p 1409-1413
(BLL-PO-Trans-3533-(7737.47)) Avail: British Library Lending Div., Boston Spa, Eng.

The products of the thermal degradation of a mixture of polyvinyl chloride (PVC) and polyvinyl propylene (PP) at 200 C were analyzed and products of the radical degradation of PP were found among them. The quantity of HCl given off per radical formed was determined. The kinetics of dehydrohalogenation of PVC was studied at different temperatures and for different concentrations of HCl in the presence of various mixtures. The results are interpreted in light of the initiated thermal degradation caused by the bimolecular interaction of labile chlorine atoms with H atoms from the polymer, to form HCl molecules and two macroradicals from which more HCl can be split off to give macromolecules with double bonds. HCl facilitates iono-molecular reactions in PVC and the degradation of PVC. G.Y.

N78-28238 British Library Lending Div., Boston Spa (England).
DENSIFICATION IN THE HOT PRESSING OF ALUMINA-ANALYSIS WITH SEVERAL RATE EQUATIONS
Makoto Kinoshita, Saburo Kose, and Yoshiteru Hamano Feb. 1978 19 p refs Transl. into ENGLISH from Yogyo Kyokai Shi (Japan), v. 81, no. 1, 929, 1973 p 16-24
(BLL-RTS-10428) Avail: British Library Lending Div., Boston Spa, Engl.: 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Densification phenomena in the hot pressing of ceramic materials were studied chiefly in relation to oxides such as alumina and beryllia, for which a variety of mass transfer mechanisms, and densification rate equations or relations based on these mechanisms, were proposed. Most of the work published proposes a dominant densification mechanism and process, derives a rate equation from this, and demonstrates the validity of the mechanism and rate equation by applying experimental data to the equation. Although densification mechanisms should be investigated by analyzing the same experimental data with different rate equations, the existing literature cannot be said to have presented adequate usable experimental data. It is therefore difficult to make such an investigation using literature data. G.Y.

N78-28239 British Library Lending Div., Boston Spa (England).
EXPLANATION OF SUPERHEATING PHENOMENA ON MELTING HIGH-POLYMER SUBSTANCES
H. G. Zachmann Mar. 1978 12 p refs Transl. into ENGLISH from Kolloid-Z. Z. Polym. (West Germany), v. 206, no. 1, 1965 p 25-29
(BLL-RTS-10608) Avail: British Library Lending Div., Boston Spa, Engl.: 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

On melting of a completely crystallized material with stretched chains, at first small noncrystalline regions form consisting of short chain fragments. The number of conformations which these chain fragments can assume is smaller than those later in the melted sample. Therefore, the gain in entropy at the start of the melting process is relatively low, which necessarily leads to superheating phenomena. In the partially crystalline material, superheating phenomena in general does not appear, since here the decrease in the chain tension in the noncrystalline regions during melting increases the gain in entropy. The entropic effects studied in this work are taken into account in addition to the interface tension usually considered. Author

N78-28240 British Library Lending Div., Boston Spa (England).
EPOXY RESIN MOISTURE-AND WATERPROOFNESS AND THEIR IMPROVEMENT
N. Aoki Feb. 1978 27 p refs Transl. into ENGLISH from Raba Daijesuto (Japan), v. 28, no. 2, 1976 p 38-51
(BLL-RTS-10877) Avail: British Library Lending Div., Boston Spa, Engl.: 14 BLL overseas, 15 European or 60 UK BLL photocopy coupons

The three major topics of discussion are: (1) epoxy resins

usefulness; (2) carbon filament reinforced resins and water; (3) glass fiber reinforced epoxy resin moisture and waterproofness. Data tables are presented which measure such parameters as: (1) composition of epoxy and nonepoxy resin matrix compounded materials; (2) shear strength and weight changes; (3) bending strength; (4) water absorption; and (5) general properties; as they relate to exposure to moist conditions. G.Y.

N78-28241 British Library Lending Div., Boston Spa (England).
ASSESSMENT OF TIME FOR MAKING SEAMS WITH MELT-ADHESIVES
N. V. Tverdyukov, S. N. Gavrilov, Yu. L. Bondarenko, and A. S. Shvarts Nov. 1977 10 p refs Transl. into ENGLISH from Kozh. Obuvn. Prom. (Moscow), no. 12, 1976 p 36-39
(BLL-RTS-10971) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

A durability assessment was carried out on an apparatus for determining cold fluidity of melt-adhesives in air. A model of lasting seam overlap type was used. Samples were tested at every value of stress and temperature. Experimental results were processed by mathematical statistical methods. The principles governing increased durability of a seam during production as a result of reducing its temperature are examined. Formulas which take into account durability, stress, and temperature are given to assess the production time for folding and lasting seams. G.Y.

N78-28242 British Library Lending Div., Boston Spa (England).
THERMOMECHANICAL FIBRE AND ITS MORPHOLOGICAL PROPERTIES
J Polcin Jan. 1978 15 p refs Transl. into ENGLISH from Papir a Celuloza, v. 32, no. 1, 1977 p 3-6
(BLL-RTS-11002) Avail: British Library Lending Div., Boston Spa, Engl.: £ 7.50; 7 overseas, 8 European or 30 UK BLL photocopy coupons

Microscopic studies are reported on the morphological features for classical ground wood pulp, fibers obtained from wood chips heated in an Asplund defibrator, and fibers from thermomechanical treated wood pulp. Whereas ground wood pulp offers moderately fibrilized fibers, altough with too large a percentage of short fibers, the Asplund process produces longer fibers that are however incapable of the more intense fibrilation indispensable for achieving satisfactory paper properties. TMV gives fibers that are fairly long and abundantly fibrilized, which are favorably manifested in the formation of interfiber linkages in the paper. The strength of TMV fibers is from one third to twice that of ground fiber or Asplund material. G.G.

N78-28243 British Library Lending Div., Boston Spa (England).
INTERNAL STRESSES IN POLYMER COATINGS
A. T. Sanzharovskii, G. I. Epifanov, and A. T. Lomakin Feb. 1978 33 p refs Transl. into ENGLISH from Lakokrasoch. Mater. Ikh Primen. no. 3, 1962 p 21-31
(BLL-RTS-11024) Avail: British Library Lending Div., Boston Spa, Engl.: 14 overseas, 15 European or 60 UK BLL photocopy coupons

The formation of internal stresses in a number of polymer coatings was investigated and it is shown that the internal stresses in polymer and paint coatings arise because of shrinkage processes taking place in the hardening of the coating. Plasticizers, introduced into coatings, essentially lower the elastic modulus and thereby reduce maximally possible internal stresses, and they increase shrinkage magnitude which leads to an essential decrease in actual internal stresses in comparison with limiting stresses. G.G.

N78-28244 British Library Lending Div., Boston Spa (England).
INTERNAL STRESSES AND THE ADHESION OF FILLED POLYTHENE TO STEEL
M. M. Kalnyn, V. P. Karlivan, and Ch. M. Miklashevich Dec. 1977 7 p refs Transl. into ENGLISH from Uch. Zap. Rizskii Politekhnicheskii Inst., v. 27, no. 10, 167 p 149-153
(BLL-RTS-11025) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 overseas, 8 European or 30 UK BLL photocopy coupons

The magnitude of the residual adhesion of filled polythene to steel increases as the level of filling is increased, despite the gain in limiting internal stresses. At a given proportion of filler the limiting internal stresses decrease in the order, quartz sand, talc, asbestos (used as fillers), but the magnitude of the adhesion increases. G.G.

N78-28245 British Library Lending Div., Boston Spa (England).
ELECTROKINETIC INVESTIGATIONS ON FIBERS. 2: EXPERIMENTAL INVESTIGATIONS
W. Aichele, E. Schollmeyer, and H. Herlinger Jul. 1978 16 p refs Transl. into ENGLISH from Makromol. Chem. (Switzerland), v. 178, no. 7, 1977 p 2025-2035
(BLL-RTS-11096) Avail: British Library Lending Div., Boston Spa, Engl.

An apparatus to measure streaming potentials and streaming currents at different concentrations of the solid is described. Zeta potentials can be corrected by conductivity measurements using Ag/AgCl electrodes directly in dilute aqueous solutions containing more than 0.001 mole/l of KCl. They are in good agreement with the real variation of zeta potentials with the porosity of the plug. At concentrations of KCl lower than 0.001 mole/l this correction must be done separately from measurements of the streaming potential. Among the various porosities given, that of Mastin best describes the variation of the zeta potential with the concentration of the solid for any kind of plug. These results and the limits of the approximation method are discussed. G.Y.

N78-28246 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A MODEL FOR CASTING POLYESTERS Ph.D. Thesis
Selami Yalcin Pusatcioglu 1977 171 p
Avail: Univ. Microfilms Order No. 7807221

Temperature distribution through the thickness of the polymer mass was obtained by monitoring thermocouples placed at known locations with the aid of a PDP-11/40 computer. Both isothermal and dynamic techniques of differential scanning calorimetry were used to obtain the heats of reaction and a kinetic expression for the polymerization reaction. The thermal properties of the polyester were determined as a function of temperature, and also attempts were made to measure these properties as a function of extent of reaction. Simulation of the curing process was based upon differential equations describing one dimensional unsteady state conductive heat transfer through the casting and the rate of crosslinking reaction. The numerical scheme presented predicts the temperature and concentration profiles during the curing process. Dissert. Abstr.

N78-28247*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF OXYGEN AND NITROGEN INTERACTIONS ON FRICTION OF SINGLE-CRYSTAL SILICON CARBIDE
Kazuhisa Miyoshi and Donald H. Buckley (Kanazawa Univ., Japan) Jul. 1978 22 p refs
(NASA-TP-1265; E-9424) Avail: NTIS HC A02/MF A01 CSCL 11G

Friction studies were conducted with single-crystal silicon carbide contacting silicon carbide and titanium after having been exposed to oxygen and nitrogen in various forms. After they had been sputter cleaned, the surfaces were (1) exposed to gaseous oxygen and nitrogen (adsorption), (2) ion bombarded with oxygen and nitrogen, or (3) reacted with oxygen (SiC only). Auger emission spectroscopy was used to determine the presence of oxygen and nitrogen. The results indicate that the surfaces of silicon carbide with reacted and ion-bombarded oxygen ions give higher coefficients of friction than do argon sputter-cleaned surfaces. The effects of oxygen on friction may be related to the relative chemical, thermodynamic properties of silicon, carbon, and titanium for oxygen. The adsorbed films of oxygen, nitrogen, and mixed gases of oxygen and nitrogen on sputter-cleaned, oxygen-ion bombarded, and oxygen-reacted surfaces generally reduce friction. Adsorption to silicon carbide is relatively weak. Author

N78-28248# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
SYNTHETIC OIL BASE STOCK AND ITS IMPACT ON NEW AND USED ENGINE OIL ANALYSES Interim Report
L. L. Stavinoha, S. J. Lestz, and M. E. LePera (US Army Mobility Equipment Res. and Develop. Command) Jan. 1978 32 p refs Presented at the 1978 Symp. on Oil Analysis, Erding West Germany; sponsored by the German Armed Forces

(Contracts DAAK70-78-C-0001; DAAG53-76-C-0003)
(AD-A053375; AFLRL-100) Avail: NTIS HC A03/MF A01 CSCL 11/8

During the past decade synthetic oils have been introduced into engine test programs in the U.S. Army. These test programs have ranged from evaluation of vehicle fleet operation to engine test development for arctic engine oil specifications. Both performance and physico-chemical properties have been evaluated including the development of analytical schemes to identify lubricant base stock composition. In many respects, routine oil analyses have not been influenced by the nature of a lubricant's base stock (as to whether it is mineral oil or synthetic oil base stock). However, some laboratory tests have been rendered useless while others have been enhanced with respect to their applicability to synthetic-based lubricants as opposed to mineral oil-based lubricants. This report has as its objective to place in perspective the Army's experience primarily with ground vehicle engine lubricants so as to illustrate the impact synthetic and hybrid oil base stocks have had in the analysis of new and used engine oils. GRA

N78-28249# Naval Civil Engineering Lab., Port Hueneme, Calif.
REPAIR SYSTEM FOR DAMAGED COATINGS ON NAVY ANTENNA TOWERS, PART 1 Progress Report, Jul. 1973 - Sep. 1976
L. K. Schwab and R. W. Drisko Mar. 1978 81 p refs
(AD-A053507; CEL-TN-1516) Avail: NTIS HC A05/MF A01 CSCL 16/3

A series of epoxy coating systems (some solvent-based and some water-emulsion) and an alkyd coating system were exposed on steel panels to a tropical environment for use in repair of damaged coatings on antenna towers. Laboratory bonding tests were conducted before and after exposure. Three candidate coating repair systems were applied on a tank exterior at San Nicolas Island, and a larger experiment using two surface preparations and 16 coating systems on an antenna positioner. Coating systems are also being -- or have been -- exposed in a laboratory salt spray cabinet. Results of all these studies are described in this report. GRA

N78-28250# Sandia Labs., Albuquerque, N. Mex.
CABLE JACKET AGING STUDY: COMPARISON OF POLYETHER AND POLYESTER URETHANE MATERIALS
L. H. Jones Feb. 1978 49 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0856) Avail: NTIS HC A03/MF A01

Accelerated aging experiments for up to 310 days duration were carried out on three polyester and three polyether urethane materials. The aging environments selected were: (1) oven aging up to 100 C; (2) water immersion up to 70 C; (3) various combinations of relative humidity and temperature up to 100% R.H. and 50 C; and (4) 0.48% (by volume) NO2 in air. The sample properties followed included; (1) physical dimensions; (2) hardness; (3) weight; (4) ultimate elongation; (5) ultimate tensile strength; (6) 300% tensile modulus; and (7) adhesive bond strengths. Dimensional and hardness measurements were not sensitive to sample degradation. Weight changes and the three tensile properties were more useful in following the degradation process. The results indicated that the polyesters are superior in both elevated temperature and NO2 service; the polyethers are superior in water immersion and humid environments. Deterioration of the adhesive bond strength in the polyesters was more severe under humidity cycling. ERA

N78-28251# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Plastiques.
OPTIMIZATION OF THE CHARACTERISTICS OF STRUCTURAL REINFORCED PLASTICS. PART 2: APPLICATIONS AND COMPUTER PROGRAMS [OPTIMISATION DES CARACTERISTIQUES DES PLASTIQUES ARMES STRUCTURAUX. DEUXIEME PARTIE: APPLICATIONS ET PROGRAMMES DE CALCUL]
Jacques Rondal (Liege Univ.) and Fernand Vidouse Nov. 1977 94 p refs In FRENCH; ENGLISH summary Sponsored by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.
(CRIF-PL-12) Avail: NTIS HC A05/MF A01

The application of a method for optimizing standard design in reinforced plastics to the optimal dimensioning of plates is discussed. Listings of the computer programs REGIPLEX for problems without operational constraints, SIMPLEX for problems with linear constraints, and COMPLEX for nonlinear problems are annexed. The programs are written in FORTRAN 4 G for IBM 370 computers. ESA

N78-28252# Battelle Memorial Inst., Geneva (Switzerland). Dept. of Metallurgy and Inorganic Materials.
BONDING INCOMPATIBLE MATERIALS WITH NEW GLASS CERAMIC SOLDERS
Jul. 1976 12 p
Avail: NTIS HC A02/MF A01

Glass ceramic solders as alternatives for conventional metal or glass solders and organic adhesives for the production of gas-tight mechanically strong bonds between dissimilar materials are discussed. Characteristics of glass ceramic solders, methods of application on substrates, and adhesive properties are dealt with. ESA

N78-28253# National Technical Information Service, Springfield, Va.
LUBRICATING OIL ANALYSIS FOR WEAR MONITORING. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Progress Report, 1964 - Mar. 1978
Diane M. Cavagnaro Apr. 1978 107 p Supersedes NTIS/PS-77/0080
(NTIS/PS-78/0338/0; NTIS/PS-77/0080) Avail: NTIS HC $28.00/MF $28.00 CSCL 11H

Abstracts of world-wide work on the methods and results of analyzing engine oils to study wear to study wear processes in internal combustion engines are presented. Methods used include radioactive tracers, liquid scintillation counting, spectrometry, sonic analysis, scanning electron microscopy, and many others. Programs to predict incipient engine failure are also reported. GRA

N78-28254# National Technical Information Service, Springfield, Va.
LUBRICATING OIL ANALYSIS FOR WEAR MONITORING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1967 - Mar. 1978
Diane M. Cavagnaro Apr. 1978 140 p Supersedes NTIS/PS-77/0079; NTIS/PS-75/688; NTIS/PS-75/048
(NTIS/PS-78/0339/8; NTIS/PS-77/0079; NTIS/PS-75/688; NTIS/PS-75/048) Avail: NTIS HC $28.00/MF $28.00 CSCL 11H

Chemical analysis of lubrication oils to determine and monitor the wear of engines or transmissions is considered. The purpose of this analysis is to predict failure before it occurs in order to allow time to undertake corrective maintenance. Many of these reports are part of the Army's Spectrometric Oil Analysis Program (SOAP). Various detectors and methods are cited, as well as their implementation. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N78-28255 British Library Lending Div., Boston Spa (England).
METHANOL AS A FUEL FOR SELF-MOVING PARTS USED IN CLOSED ENVIRONMENTS
G. Salvi Jul. 1978 23 p refs Transl. into ENGLISH from Riv. dei Combustibili (Italy), v. 30, nos. 5-6, 1976 p 147-155 (BLL-RTS-10951) Avail: British Library Lending Div., Boston Spa, Engl.

Methanol was used experimentally as a fuel in internal combustion engines operated in closed environments; thanks to the antiknock properties of the alcohol, with high air/fuel ratios, combustion gases are obtained containing 2-3% oxygen and very low concentration of pollutants. The absence of lead compounds in the exhausts allows a catalytic muffler to be fitted into the

exhaust manifold so as to obtain practically nonpollutant exhausts under conditions of great efficiency and for long periods of time. In this way, it is possible to operate lift trucks, tractors, cleaning machines and other machines in stores, sheds and mines, with internal combustion engines, overcoming the serious problems of a health nature met with to date. Author

N78-28256*# Cohen (Norman) Professional Services, Redlands, Calif.

COMBUSTION RESPONSE MODELING FOR COMPOSITE SOLID PROPELLANTS Final Report

30 Dec. 1977 48 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954627)
(NASA-CR-157319; JPL/AFRPL-76-F) Avail: NTIS HC A03/MF A01 CSCL 21I

A computerized mathematical model of the combustion response function of composite solid propellants was developed with particular attention to the contributions of the solid phase heterogeneity. The one-dimensional model treats the solid phase as alternating layers of ammonium perchlorate and binder, with an exothermic melt layer at the surface. Solution of the Fourier heat equation in the solid provides temperature and heat flux distributions with space and time. The problem is solved by conserving the heat flux at the surface from that produced by a suitable model of the gas phase. An approximation of the BDP flame model is utilized to represent the gas phase. By the use of several reasonable assumptions, it is found that a significant portion of the problem can be solved in closed form. A method is presented by which the model can be applied to tetramodal particle size distributions. A computerized steady-state version of the model was completed, which served to validate the various approximations and lay a foundation for the combustion response modeling. The combustion response modeling was completed in a form which does not require an iterative solution, and some preliminary results were acquired. A.R.H.

N78-28257# National Aviation Facilities Experimental Center, Atlantic City, N. J.

DESIGN OF AN APPARATUS FOR TESTING THE FLAMMABILITY OF FUEL SPRAYS Final Report, Jul. 1975 - Dec. 1977

Thor I. Eklund and William E. Neese May 1978 31 p refs
(FAA Proj. 181-520-100)
(AD-A054511; FAA-NA-78-6; FAA-RD-78-54) Avail: NTIS HC A03/MF A01 CSCL 21/4

An automated small scale test apparatus was developed for flammability testing of modified fuels. The test configuration consists of a 1/4 inch fuel delivery tube within a 1 inch air atomization pipe followed by a diffuser section. A pressurized 30 gallon air tank supplies the atomization air while a syringe pump provides a specified fuel quantity for all tests. Isentropic calculations and hot wire anemometer measurements characterize the air flow during the transient air release. Oscillograph traces specify the sequencing and timing of events. It is concluded that this transient test is a practical device for modified fuel testing because of its simple construction, well defined operation, and capability of distinguishing between candidate additives. Author

N78-28258# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.

THREE-DIMENSIONAL FINITE ELEMENT ANALYSIS OF A SOLID PROPELLANT GRAIN TRANSITION REGION

Robert M. Hackett Nov. 1977 145 p refs
(AD-A053607; DRDMI-T-78-18) Avail: NTIS HC A07/MF A01 CSCL 21/9

A three-dimensional finite element analysis of the transition region, from a star cross-section to a cylindrical bore cross-section, for a typical solid propellant rocket motor grain configuration is carried out. The recently developed TEXGAP-3D (Texas Grain Analysis Program, 3-Dimensional) static linear elastic stress analysis computer program is employed in the analysis. Two loading conditions, combustion pressure and thermal, are considered, along with corresponding transition interface displacements obtained from previous two-dimensional finite element analyses of the uniform grain regions. Author (GRA)

N78-28259# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.

ASSESSMENTS OF RECENT MODELS FOR PRESSURE AND VOLUME EFFECTS ON REACTIONS OF BALLISTIC MATERIALS

George F. Adams and J. Richard Ward Apr. 1978 26 p refs
(DA Proj. 1W1-61102-AH-43)
(AD-A054640; AD-E430030; ARBRL-TR-02055) Avail: NTIS HC A03/MF A01 CSCL 19/1

Two recent attempts to describe the pressure and volume dependence of the reactions of ballistic materials are assessed. It is concluded that the compression enhancement model correlates some experimental data on propellant burning rates; however, the physical model is incorrect. Analysis of another theory demonstrates that simplest possible models do not provide a description of the pressure (volume) dependence of reactive material behavior. Existing theories are reviewed, and a novel mechanism is suggested for the participation of electronic excited states in the decomposition of nitrate ester compounds. Author (GRA)

N78-28260# Los Alamos Scientific Lab., N. Mex.

EXPLO: EXPLOSIVES THERMAL ANALYSIS COMPUTER CODE

Dwight L. Jaeger Jan. 1978 42 p refs
(Contract W-7405-eng-36)
(LA-6949-MS) Avail: NTIS HC A03/MF A01

The finite difference method is used to calculate temperature fields and times to initiation for explosive materials. The code is one dimensional and is programmed for Cartesian, cylindrical, and spherical coordinates. Temperature dependent properties, phase changes, and multiple heat source terms are allowed. Multiple source terms use first order Arrhenius kinetics for each material component. Temperature, flux, or convection boundary conditions may be employed. Internal convection is considered for materials that undergo a solid-liquid phase change. The Crank-Nicholson implicit solution method, which allows large time steps and short running time, is used. ERA

N78-28261# Mound Lab., Miamisburg, Ohio.

RESPONSE OF LASL DETONATORS TO A.C. VOLTAGE

G. E. Round, T. S. Chou, and J. R. Taylor 17 Feb. 1978 23 p ref
(Contract EY-76-C-04-0053)
(MLM-2492) Avail: NTIS HC A02/MF A01

Modern LASL detonators were subjected to three alternating current waveforms to determine the susceptibility of the detonators to high-order detonations when the line voltages supplied by local utility companies are applied across the detonator electrodes. Dent blocks were used for each test to resolve whether a high-order detonation was obtained. Some of the detonators were confined in mock H.E. inserts to compare the performance of a confined detonator with that of an unconfined detonator. The 1E30, 1E31, 1E33, and SE-1N detonators were investigated on three voltage waveforms, nominally 110, 208, and 440 V. The detonators either deflagrated or failed. The statistical probability, derived from the test results, of attaining a deflagration when one of these detonators is plugged into a wall outlet at any of the waveforms was between 70 and 85 percent. ERA

N78-28262# SRI International Corp., Menlo Park, Calif.

HOMOGENEOUS CATALYTIC HYDROCRACKING OF COAL TO LIQUID FUELS: BASIC AND PROCESSES FOR CONVERSION OF COAL TO LIQUID FUELS: BASIC AND EXPLORATORY RESEARCH Monthly Report, Sep. 1977

3 Nov. 1977 7 p
(Contract EX-76-C-01-2202)
(FE-2202-23; MR-23) Avail: NTIS HC A02/MF A01

MeOH was found to be more effective than i-PrOH in the base-catalyzed cleavage of the model compound phenyl ether (Ph-o-Ph), and with much less alcohol condensation. Also, CO in the presence of H2O and KOH effectively reduces coal in reactions at 400 C (753 F) for 20 min, providing about 20% hexane soluble and 50% benzene soluble products, with the remainder being pyridine soluble. The interaction of Illinois No.6 (PSOC-25) coal with a 50/50 mixture of tetralin and decane and also with dihydronaphthalene were determined at 400 C.

Coal treated with the tetralin decane mixture yielded products about half as soluble in pyridine as those obtained with pure tetralin. Under the same conditions dihydronaphthalene was superior to Tetralin for coal solubilization at 400 C and reaction times up to 4 min. Illinois No. 6 coal from Franklin County was treated with tetralin at 400 C for reaction times from 30 sec to 4 min. ERA

N78-28263# Department of Energy, Washington, D. C. Div. of Solar Energy.
RESEARCH AND DEVELOPMENT FOR FUELS FROM WOODY BIOMASS Program Research and Development Announcement
14 Nov. 1977 194 p
(TID-28024; ET-78-D-01-4126) Avail: NTIS HC A09/MF A01

A program is summarized which develops biomass resources to produce clean fuels, petrochemical substitutes, and other energy incentive products. These products will supplement similar products made from conventional fossil fuels. All forms of plant materials, those grown on land and in water were considered. Forest and crop residues, crops grown for their energy content, and animal manures were also considered. Research and development in the following areas were conducted: (1) growing biomass; (2) harvesting, collection, transporting, and storing biomass; and (3) converting biomass. Author (ERA)

N78-28264# California Univ., Livermore. Lawrence Livermore Lab.
LX-14: A NEW HIGH-ENERGY PLASTIC-BONDED EXPLOSIVE
J. R. Humphrey 21 Nov. 1977 62 p refs
(Contract W-7405-eng-48)
(UCRL-52350) HC A04/MF A01

The LX-14-0, a general purpose, plastic-bonded explosive (PBX) containing 95.5 wt% HMX and 4.5 wt% Estane 5702-F1 polyurethane was developed and tested. This composition has high energy, low sensitivity to handling and shock, and has mechanical properties that are superior to other PBXs now in use. ERA

N78-28265# Los Alamos Scientific Lab., N. Mex.
SAFE-STATIONARY DETONATION TRAIN FOR ARMY ORDNANCE
J. H. Goforth Mar. 1978 7 p ref
(Contract W-7405-eng-36)
(LA-7123-MS) Avail: NTIS HC A02/MF A01

Experiments were conducted to demonstrate the feasibility of designing safe stationary detonation trains for Army ordnance. A system is described that required three detonation trains to be fired simultaneously to detonate a PBX 9407 acceptor charge separated physically from the detonation trains by an aluminum barrier. The system detonates the acceptor when a 0.62 mm thick inert barrier separates the acceptor from three trains. A barrier less than 0.25 mm thick is required for a single train to detonate the acceptor. The system described involves no moving parts, no physical contact between detonation trains and the acceptor charge, and is practicable for high volume, low cost production. ERA

N78-28266# California Univ., Berkeley. Lawrence Berkeley Lab.
PILOT PLANT STUDIES OF THE BIOCONVERSION OF CELLULOSE AND PRODUCTION OF ETHANOL
C. R. Wilke 30 Sep. 1977 15 p
(Contract W-7405-eng-48)
(LBL-6861) Avail: NTIS HC A02/MF A01

Results of the following studies are reported: analysis and evaluation of potential raw materials--chemical analysis of the Kudzu plant and effect of NO/sub x/pretreatments on the hydrolysis of wheat straw; utilization of hemicellulose sugars; process design and economic studies--hydrolysis process and ethanol fermentation; pilot plant process development and design studies-enhanced cellulase production and continuous hydrolysis. Author (ERA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N78-28267 Engineering Sciences Data Unit, London (England).
ENGINEERING SCIENCES DATA UNIT INDEX 1977-1978
1978 410 p
(ESDU-Index-77-78) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $10.00

Since beginning work in 1964 on a series of design data to assist the mechanical engineering industry, ESDU developed on a self supporting basis that side of its service to the extent that in 1976 a majority of its work was initiated for the needs of general engineering. Of particular importance to mechanical engineers of the items added in 1976 were those on crack propagation in steels, fatigue strength of welded joints, analysis and synthesis of crankrocker mechanisms, and the revised item on design and selection of dry rubbing bearings. ESDU is extending its services further into the intermediate area between the data sheet on the one hand and the sophisticated program on the other. This index contains reference to ESDUpac 1001, a comprehensive code for the analysis of plate buckling, and ESDUpac 2001, the ESDU data bank on two phase flow pressure drop. ESDU

N78-28268 British Library Lending Div., Boston Spa (England).
STATE OF KNOWLEDGE RESPECTING COMBUSTION-SPACE OSCILLATIONS AND WAYS OF SUPPRESSING THEM
K. Leikert Mar. 1978 22 p refs Transl. into ENGLISH from V G B Kraftwerkstechnik (West Germany), no. 5, 1976 p 327-333
(BLL-RTS-10531) Avail: British Library Lending Div., Boston Spa, Engl.: 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The oscillatory phenomena that give rise to boiler roar are excited natural oscillations in the combustion space of the heating-surface passages leading from it. Roar in the audible ran-e can be accompanied by vibrations in the 3 to 10 Hz range, which can be dangerous under certain circumstances because they are inaudible, and cannot be immediately detected. A boiler capable of operating satisfactorily over a wide load range can enter a critical state and vibrate strongly when one of the basic parameters (load, burner combination, excess air ratio, changeover from oil to gas) is varied. Means of suppressing these oscillations include: altering the shape and location of the flame holder; altering the fuel injection; or modifying the air path through the burner by adjusting the spin or the air flow rate in the core. A.R.H.

N78-28269*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A SURVEY OF ELECTRIC AND HYBRID VEHICLE SIMULATION PROGRAMS, VOLUME 1 Final Report
J. Bevan, D. A. Heimburger, and M. A. Metcalfe 1 Jul. 1978 109 p Sponsored by DoE
(Contract NAS7-100)
(NASA-CR-157342; JPL-Pub-78-58) Avail: NTIS HC A06/MF A01 CSCL 13F

Development and capabilities of automotive performance simulation programs suitable for electric and hybrid vehicle studies are considered. G.G.

N78-28270# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Concrete Lab.
IDENTIFICATION OF CANDIDATE ZERO MAINTENANCE PAVING MATERIALS, VOLUME 1 Final Report
George C. Hoff, comp., Lenford N. Godwin, Kenneth L. Saucier, Alan D. Buck, Tony B. Husbands, and Katharine Mather May 1977 292 p refs 2 Vol.
(FHWA Order 4-1-0189)
(AD-A053793; WES-MP-C-77-14-Vol-1; FHWA-RD-77-109-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 13/3

A broad spectrum of materials which may have potential for improving the characteristics of pavements with regard to

reducing future maintenance were reviewed with those materials or materials systems possessing the most advantages being considered as candidates for a zero maintenance paving system. These included Gussasphalt, asbestos asphalts, sulfur modified asphalts, noncalcareous inorganic cements (sulfur and phosphate), (Portland cement concrete and expansive cements, discussed in Volume 1. Volume 2 considers fiber reinforced concrete, polymers in concretes, sealants, ceramics, prestressed concrete and vacuum processed concrete. These materials were compared to conventional asphalt and portland cement concrete systems on the basis of mechanical properties, ease of construction and maintenance, environmental compatibility, availability, cost, and possible uses. None of the materials or materials systems studied will provide a singular answer to the problem of zero maintenance. However, many of the materials possess characteristics which could be incorporated into pavements to greatly extend the period prior to maintenance. GRA

N78-28271# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Concrete Lab.
IDENTIFICATION OF CANDIDATE ZERO MAINTENANCE PAVING MATERIALS, VOLUME 2 Final Report
George C. Hoff, comp., Lenford N. Godwin, Kenneth L. Saucier, Alan D. Buck, Tony B. Husbands, and Katharine Mather May 1977 400 p refs 2 Vol.
(FHWA Order 4-1-0189)
(AD-A053794; WES-MP-C-77-14-Vol-2; FHWA-RD-77-110-Vol-2) Avail: NTIS HC A17/MF A01 CSCL 13/3

A broad spectrum of materials which may have potential for improving the characteristics of pavements with regard to reducing future maintenance were reviewed with those materials or materials systems possessing the most advantages being considered as candidates for a zero maintenance paving system. This volume considers fiber reinforced concrete, polymers in concretes, sealants, ceramics, prestressed concrete and vacuum processed concrete. These materials were compared to conventional asphalt and portland cement concrete systems on the basis of mechanical properties, ease of construction and maintenance, environmental compatibility, availability, cost, and possible uses. None of the materials or materials systems studied will provide a singular answer to the problem of zero maintenance. However, many of the materials possess characteristics which could be incorporated into pavements to greatly extend the period prior to maintenance. GRA

N78-28272# Textron Bell Aerospace Co., Buffalo, N. Y.
LACV-30 PRE-DELIVERY WATER TEST PROGRAM Final Technical Report, Mar. - Nov. 1975
W. G. Cockayne Feb. 1978 28 p refs
(Contract DAAK02-75-C-0149)
(AD-A053687; BAC-7467-928006) Avail: NTIS HC A03/MF A01 CSCL 01/3

A limited over water test program was conducted on the LACV-30-1 craft prior to its planned delivery to the U.S. Army for Acceptance Tests. The objectives of these tests were to provide for the initial shakedown of the craft and subsystems and to establish the basic performance characterictics and compatibility of the craft with its water environment. To accomplish these objectives, check-out test and over water handling quality, performance and miscellaneous tests were planned. These tests were conducted on Lake Huron at the Bell Aerospace Textron Facility at Grand Bend, Ontario, Canada, during the period from October 16 to October 28, 1975. Tests were made in all of the planned categories although the number made in some cases was less than planned due to normal craft shakedown problems. The results of these tests showed that the craft handled well but that the performance was not as good as predicted. This was due primarily to larger than expected leakage at the stern trunk intersections with the side trunk and longitudinal keel that existed on the craft at the time of the tests. The stern seal has since been modified to alleviate this problem. Author (GRA)

N78-28273# Textron Bell Aerospace Co., Buffalo, N. Y.
PERFORMANCE OF THE LACV-30 AIR MANAGEMENT SYSTEM ORIGINAL CONFIGURATION Final Technical Report
Frank Bond Feb. 1978 50 p ref 2 Vol.
(Contract DAAK02-75-C-0149)
(AD-A053688; BAC-7467-928007) Avail: NTIS HC A03/MF A01 CSCL 01/3

In response to early indications of excessive sand ingestion through the LACV-30 main engines and low pressures at their inlets, the inlet Air Management System was instrumented for air flows, pressures and temperatures and tested at various power conditions. These tests confirmed the presence of negative pressures at the inlets and provided data showing where the principal pressure losses occurred. Concurrent analysis of the original two-stage filtration system demonstrated that at its design filtration efficiency it would pass excessive amounts of particulates when operating in the high sand and dust environment experienced during testing at Fort Story, Va. It was concluded that a third stage of filtration must be added to the system. A modified AMS configuration incorporating additional filtration, a diffuser at the fan exit, an enlarged entrance to the engine inlet compartment, and shifting the oil cooler air load from the AMS fan to the lift system was designed and analyzed. GRA

N78-28274# Textron Bell Aerospace Co., Buffalo, N. Y.
PERFORMANCE OF THE LACV-30 AIR MANAGEMENT SYSTEM MODIFIED CONFIGURATION Final Technical Report
Frank Bond Feb. 1978 85 p ref 2 Vol.
(Contract DAAK02-75-C-0149)
(AD-A053689; BAC-7467-928008) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report presents the results of a test program to evaluate candidate modifications to the Air Management System of the LACV-30 and to verify adequate performance of the modified design after it had been fabricated and installed on the vehicle. It demonstrates that the modified AMS does maintain positive pressures at the main engine inlets. Author (GRA)

N78-28275# Textron Bell Aerospace Co., Buffalo, N. Y.
PILOT MODEL AIR CUSHION VEHICLE (LACV-30) PROGRAM Final Technical Report, Mar. 1975 - Feb. 1978
Robert P. Kaiser Feb. 1978 15 p refs
(Contract DAAK02-75-C-0149)
(AD-A053686; BAC-7467-928010) Avail: NTIS HC A02/MF A01 CSCL 01/3

This report presents summaries of seven Final Reports of vehicle, subsystem and model test investigations performed by Bell Aerospace Textron under the Pilot Model Air Cushion Vehicle (LACV-30) Contract No. DAAK 02-75-C-0149. Summaries are also presented of six BAT IR and D investigations of its Stretched Voyageur vehicle which have some relevance to the LACV-30. Author (GRA)

N78-28276# Textron Bell Aerospace Co., Buffalo, N. Y.
LACV-30 TEST AND DEMONSTRATION REPORT Final Report
Marion M. Laszewski Feb. 1978 161 p refs
(Contract DAAK02-75-C-0149)
(AD-A053610; BAC-7467-928009) Avail: NTIS HC A08/MF A01 CSCL 01/3

This report presents the test data and analysis of all acceptance and type tests performed on the LACV-30-1 and -2 vehicles. The tests were performed as specified in Contract No. DAAK02-75-C-0149 dated 7 March 1975. All test data were accepted by the U.S. Army prior to delivery of the vehicles. Two corrective actions were required on the LACV-30-1, installation of a new horn and addition of bow pre-loaders to maintain pressure on the front landing pads during swing crane operation. Author (GRA)

N78-28277# Textron Bell Aerospace Co., Buffalo, N. Y.
LACV-30 AUXILIARY POWER UNIT INVESTIGATION Final Technical Report, Sep. 1976 - Jan. 1977
Robert P. Kaiser Jun. 1977 97 p
(Contract DAAK02-75-C-0149)
(AD-A053566; BAC-7467-927024) Avail: NTIS HC A05/MF A01 CSCL 10/2

An investigation was performed to determine the cause and solution to a series of Auxiliary Power Unit (APU) failures on LACV-30 vehicles. Vibration and other measurements were made on the complete installation, the APU module alone, and the

engine alone. It was concluded that the APU module arrangement reinforced or excited an engine vibration mode to destructive amplitudes. The problem was solved by modifying the APU to virtually eliminate this vibration. Author (GRA)

N78-28278# Army Natick Research and Development Command, Mass.
ACCORDION SHELTER HARDWARE ANALYSIS Final Report, Feb. 1976 - Aug. 1977
Predrag Shopalovich and Franklin Barca Feb. 1978 37 p refs
(DA Proj. 1L7-62723-A-42701)
(AD-A053592; NATICK/TR-78/011) Avail: NTIS HC A03/MF A01 CSCL 13/13

This report presents the results of an investigation into some of the hardware difficulties experienced with the accordion shelter during field tests. The accordion shelter is a prototype rigid-wall, general purpose, expandable military shelter. In the closed transportation configuration the shelter serves as its own shipping container and conforms to the dimensional and strength requirements of the International Organization for Standardization Type IC freight container. In the habitation mode the container expands from both sides to form an enclosed, environmentally controlled, lighted shelter approximately 2.4 metres high by 2.4 metres wide by 15.2 metres long. The main problem areas are identified as container jacks, floor jacks, leveling system, and expansion system. The specific causes of the problems are identified and solutions to the problems are proposed.
Author (GRA)

N78-28279# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
FREEZE-THAW TESTS OF LIQUID DEICING CHEMICALS ON SELECTED PAVEMENT MATERIALS
L. David Minsk Nov. 1977 24 p
(AD-A051771; CRREL-77-28) Avail: NTIS HC A02/MF A01 CSCL 13/2

Tests were conducted to assess the extent of surface degradation resulting from the application of non-chloride deicing chemicals on three types of airfield pavements. The chemicals tested were proprietary mixtures of urea, formamide, and ethylene glycol; sodium chloride, distilled water, and dry specimens were used as controls and for comparison. Pavements included new and old specimens of open-graded asphaltic concrete and old specimens of dense-graded asphaltic concrete. Portland cement concrete specimens used were new and old, with and without air-entrainment. New and old tar rubber concrete specimens were also tested. Samples were subjected to up to 60 freeze-thaw cycles with deicing chemicals flooding their upper surface. Each specimen was rated on a scale of 0-5 after every five freeze-thaw cycles. All PCC specimens showed some surface degradation, whereas the dense- and open-graded asphaltic concretes were largely unaffected. Author (GRA)

N78-28280# Sandia Labs., Albuquerque, N. Mex.
RADIANT HEAT EVALUATION OF CONCRETE: A STUDY OF THE EROSION OF CONCRETE DUE TO SURFACE HEATING
T. Y. Chu Jan. 1978 151 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0922) Avail: NTIS HC A08/MF A01

Experiments were carried out to investigate the erosion of concrete under high surface heat flux in connection with the core-melt/concrete interaction studies. The dominate erosion mechanism was found to be melting at the surface accompanied by chemical decomposition of the concrete beneath the melt solid interface. The erosion process reaches a steady state after an initial transient. The steady state is characterized by an essentially constant erosion rate at the surface and a nonvarying (with respect to the moving melt interface) temperature distribution within the concrete. For the range of incident heat flux 64 W/sq cm to 118 W sq cm the corresponding steady state erosion rate varies from approximately 8 cm/hr to 23 cm/hr. A simple ablation melting model was proposed for the erosion process. The model was found to be able to correlate all temperature responses at various depths from all tests at large times and for temperatures above approximately 250 C. ERA

N78-28281# Stanford Linear Accelerator Center, Calif.
SHORT COURSE ON THE TEMPERATURE DETECTOR SYSTEM
Roger Anderson Sep. 1977 40 p refs
(Contract EY-76-S-03-0326)
(SLAC-TN-77-6) Avail: NTIS HC A03/MF A01

In the SLAC linac, a slow temperature rise may occur from the continuous scraping of the beam on the vacuum chamber wall. In places where this is likely to occur, surface temperature sensors are mounted on the outside of the vacuum chambers and are arranged to trip the beam if the temperature exceeds a preset level. In addition to vacuum chamber surface temperature measurements, water temperature measurements are made on the cooling water supply and return line of slits, collimators, water cooled vacuum chambers, and dumps. A discussion was given of: (1) temperature sensors; (2) temperature detector and card types; (3) digital temperature readout; (4) detector card calibration; (5) line resistance equalization; and (6) operational and maintenance problems. ERA

N78-28282# Stanford Linear Accelerator Center, Calif.
LH2 THREE-PHASE PUMP CONTROL CIRCUIT DESCRIPTION
W. Pierce May 1977 19 p
(Contract EY-76-S-03-0326)
(SLAC-TN-77-2) Avail: NTIS HC A02/MF A01

A brief description and circuit drawings was given for a pump control system. The pump is used to circulate liquid hydrogen through the cell and heat exchanger of an LH2 target. The pump is powered by three phase 60 cycle power, and the control unit is powered from a positive and negative 24 V dc supply available in the NIM Bin. The control unit is packaged in a double width NIM module. Drawings were given for the pump speed indicator, function generator, and power supply.
Author (ERA)

N78-28283# Sandia Labs., Albuquerque, N. Mex.
SUSTAINED MOLTEN STEEL/CONCRETE INTERACTIONS TESTS
D. A. Powers 1977 8 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1479C) Avail: NTIS HC A02/MF A01

Four tests of the sustained interaction between high-temperature steel melts and two varieties of concrete are described. Inductive heating was used to keep the 200Kg stainless steel melts liquid for periods of up to 20 min. Measurements of the gas composition, gas temperature, gas generation rate, aerosol emissions, upward heat-flux from the melt, and melt-temperature were made. Gases liberated from the concrete were found to be chemically reduced principally to carbon monoxide and hydrogen as they passed through the melt. The tests provided some evidence that stainless steel may also catalyze the hydrogenation of carbon monoxide to yield hydrocarbons such as methane, ethene, and ethane in the gas stream. The hydrogen/carbon ratio in the gases was not the same as the ratio in the concrete. ERA

N78-28284# Los Alamos Scientific Lab., N. Mex.
NUMERICAL SIMULATION OF WIND FORCES ON STRUCTURES
C. W. Hirt and L. R. Stein 1978 12 p refs Presented at the 3d Conf. on Wind Engr. Res., Gainesville, Fla., 26 Feb. 1978
(Contract W-7405-eng-36)
(LA-UR-77-2826; Conf-780210-1) Avail: NTIS HC A02/MF A01

The use of numerical methods to predict wind loads on structures was explored. It was concluded that useful engineering results can be obtained numerically, at reasonable cost, for many different problems. However, it was also shown that a considerable amount of new methodology was needed before numerical methods could be of general utility for wind engineering purposes. These conclusions were based on studies performed with a simple numerical solution algorithm for the time-dependent, three dimensional, Navier-Stokes equations. Calculational results are presented for a variety of simple structures subjected to uniform and boundary layer type winds. In each example the computer results are compared with wind tunnel data. ERA

N78-29036# Joint Publications Research Service, Arlington, Va.
ROBOT PRODUCTION, USE DISCUSSED
Ye. Yurevich and M. I. Kalinin *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 48-52 Transl. into ENGLISH from Leningr. Pravda (USSR), 21 May 1978 p 2
(For primary document see N78-29032 19-99)
Copyright. Avail: NTIS HC A06/MF A01

N78-29042# Joint Publications Research Service, Arlington, Va.
INSTITUTE HEAD DISCUSSES AUTOMATION, ROBOT RESEARCH
Ivan Berenyi *In its* Transl. on Eastern Europe: Sci. Affairs, No. 592 (JPRS-71458) 13 Jul. 1978 p 1-5 Transl. into ENGLISH from Zero un Informatique (Paris), 22 May 1978 p 8-9
(For primary document see N78-29041 19-99)
Avail: NTIS HC A03/MF A01

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N78-28285 British Library Lending Div., Boston Spa (England).
VARIABILITY OF THE FIELDS OF LONG-WAVE RADIATION IN THE FREE ATMOSPHERE ABOVE THE GATE AREAS
N. A. Zaitseva and T. M. Krasnova 1976 8 p refs Transl. into ENGLISH from Akad. Nauk., Sov. Nats. Kom. Prov. (Moscow), v. 1, 1976 p 542-549
(BLLD-M-24971-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Experimental data on vertical profiles of integrated long wave radiation flux were accumulated in order to determine the radiation influx of heat by long wave radiation in various layers of the atmosphere. For this purpose the following goals were proposed: (1) to study the spacial-temporal variability of the fields of long wave radiation in tropical latitudes during different atmospheric conditions; (2) to obtain data on the radiation influx of heat in various layers of the atmosphere due to long wave radiation under different cloud conditions; (3) to study the relation between the long wave radiation of the atmosphere and the effective values of temperature, humidity and cloud cover. This document presents the first stage of the investigation--the collection of the experimental data. G.Y.

N78-28286 British Library Lending Div., Boston Spa (England).
DETERMINATION OF ECHO-SIGNAL TOLERANCES IN TRANSMISSION CHANNELS ON FULL SEKAM SIGNALS
O. V. Hofeisen and H. I. Epifanov 20 Jul. 1977 19 p refs Transl. into ENGLISH from Tekhn. Kino 1 Televideniya (USSR), no. 9, 1976 p 62-68
(BLL-Trans-3487-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

The quality of a color picture essentially depends on the extent of distortion of the signal in the television channel. Information about the color picture along different parts of the channel is given by various signals. The full color television signal, by being affected by these signals, undergoes complex multiple transformations in the multichain electrical channel. It is, therefore, important to establish limits for the distortion of this signal in the form of a stencil for impulse or transient characteristics corresponding to different sections of the channel. The method of echo-signals is used for construction of these stencils. The experiments described in this paper were planned to study the occurrence of reflected signals in the channel during the transmission of the full SEKAM signal in color television and to establish the connection between the quality of the picture and distortions of this kind G.Y.

N78-28287 British Library Lending Div., Boston Spa (England).
LINE STANDARDS CONVERTERS IN A VISUAL COMMUNICATION SYSTEM
J. Ost 20 Jul. 1977 9 p refs Transl. into ENGLISH from Nachrichtentech. Z. (West Germany), v. 30, no. 3, 1977 p 239-244
(BLL-Trans-3494-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

Visual telephone systems with a number of lines lower than the TV standard (e.g. 313 lines) require special terminals with small screens. This results in an unsatisfactory picture display which is mainly due to the line interlace principle. Line standard converters are described which make it possible to employ 625 line TV terminal equipment, especially for the display. Experiments are described that used a line standards with 313 lines and 50 partial frames per second for the transmitted signal. In display (and reception) 625 lines and 50 frames per second were used. It was found that this concept can be developed into a very flexible system. G.Y.

N78-28288 British Library Lending Div., Boston Spa (England).
INMARSAT: THE NEW INTERNATIONAL ORGANIZATION FOR MARITIME COMMUNICATION BY SATELLITE
Gaetano Graziosi 5 Sep. 1977 10 p Transl. into ENGLISH from Post e Telecomun. (Italy), v. 4, no. 11/12, 1976 p 13-16
(BLL-Trans-3496-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

The agreements establishing INMARSET are discussed. This is an international organization for improving maritime communications, sea rescue services, and navigational safety on a world-wide scale. The initial investment quotas for the participating nations are listed. F.O.S.

N78-28289 British Library Lending Div., Boston Spa (England).
DIGITAL CONCENTRATOR FOR A PCM TRANSMISSION SYSTEM, PART 1
Kurt Waber 21 Jul. 1977 36 p refs Transl. into ENGLISH from Tech. Mitt. PTT (Bern), no. 4, 1977 p 160-184
(BLL-Trans-3499-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

The concentrator connects digital speech and/or data subscribers via a digital subscriber line to a PCM remote signalling system. As the remote signalling system consists of several autonomous superimposed PCM networks (levels), it also becomes the junction point of these networks. Apart from the coupling system and the junction of the networks, the digital subscriber lines, and control problems are described. The design chosen is suitable for modular assembly. G.G.

N78-28290 British Library Lending Div., Boston Spa (England).
MODEM POWER INSTALLATIONS FOR TELECOMMUNICATIONS
J. Maitre 20 Jul. 1977 18 p Transl. into ENGLISH from L'Echo des Rech. (France), no. 86, Oct. 1976 p 14-23
(BLL-Trans-3501-(7737.470)) Avail: British Library Lending Div., Boston Spa, Engl.

After first demonstrating the need for power installations, the author traces the technical and economic criteria which have dictated their construction in their most modern form. He discusses the design problems encountered and explains how they may be solved. He goes on to describe their probable development. Author

N78-28291 British Library Lending Div., Boston Spa (England).
NARROW-BAND VIDEO CODING
H. Wendt 20 Jul. 1977 16 p Transl. into ENGLISH from Nachrichtentec. Z. (West Germany), v. 30, no. 3, 1977 p 245-250
(BLL-Trans-3504-(7737.470)) Avail: British Library Lending Div., Boston Spa, Engl.

An experimental coding unit for 1 MHz video signals is described. By using data reduction techniques, it allows a transmission rate of 2 Mbit/s. Important problems are the detection of moving areas in the picture and the optimum coding algorithm for addresses and picture information. Implementation and performance of the buffer and the data flow control unit are also discussed. G.Y.

N78-28292 British Library Lending Div., Boston Spa (England).
MULTIPLEX TRANSMISSION OF STILL PICTURES IN

COLOUR OVER TELEVISION CHANNELS
23 Aug. 1977 6 p refs Transl. into ENGLISH from Funckschau (West Germany), v. 49, no. 1, 1977 p 8-10
(BLL-Trans-3510-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

A transmission system, called the Still Picture Multiplexed Television System, is described which makes possible the transmission of color stills and the relevant sound information without affecting the color television signal simultaneously broadcasted over the same channel. Topics of discussion are: (1) multiplex system; (2) the image store; (3) sound transmission; (4) pilot signals; and (5) the future outlook. G.Y.

N78-28293 British Library Lending Div., Boston Spa (England).
A 15 GHz DIGITAL MICROWAVE LINK FOR LOCAL NETWORKS
M. Daout and Y. Schifres 14 Nov. 1977 20 p Transl. from ENGLISH from Onde Elec. (Paris), vol. 57, no. 6-7, 1977 p 435-441
(BLL-PO-Trans-3535-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

Distant subscribers to a telephone exchange in country areas are concentrated together in local switching centers which are usually 10 to 30 km from the exchange. The capacity of the local connections established in this way is a few dozen circuits. It might be possible to multiplex these circuits. In view of the lower cost of time multiplexing equipment, digital transmission is the most commonly used system. By way of example, a survey study of routes for local microwave links was carried out in a central region of France, which provided some interesting information on the characteristics of this type of connection in open or flat country. This network is analyzed and the characteristics of radio propagation at 15 GHz are examined. G.Y.

N78-28294 Houston Univ., Tex.
BINARY DATA COMMUNICATION OVER AN IMPULSIVE NOISE CHANNEL Ph.D. Thesis
James Charles Vanelli 1977 154 p
Avail: Univ. Microfilms Order No. 7808099

Useful analytical techniques for determining optimum signal parameter values in binary data communication over a channel corrupted by a combination of white Gaussian noise and impulsive noise are derived and presented. The analysis is based on a linear channel model and the optimality criterion used throughout is minimization of the decision error probability. A general expression for the probability of error is also obtained on the characteristic functions of the various noise and interference terms affecting the decision. A number of applications are also considered, with numerical results presented to substantiate the analysis. Specifically, it is shown that under weak signal conditions over channels dominated by impulsive noise, signals of relatively short duration are less susceptable to the effects of impulsive noise than equal energy signals of much longer duration.
Dissert. Abstr.

N78-28295# Electromagnetic Compatibility Analysis Center, Annapolis, Md.
FAA REMOTE TERMINAL SYSTEM Final Report
Thomas Hensler (IIT Research Inst., Annapolis) Nov. 1977 103 p refs
(Contracts DOT-FA76WAI-612)
(AD-A054604; ECAC-PR-77-067; FAA-RD-78-8) Avail: NTIS HC A06/MF A01 CSCL 09/3

A system of interactive analysis programs was developed that provides automated, quick-response capabilities for use by frequency managers to solve daily frequency management problems. The system can be used to display records from the FAA Air Traffic Control (ATC) data base, provide electromagnetic compatibility analyses, make frequency assignments, and plot service volumes. G.G.

N78-28296# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
ANALYSIS OF THE PERFORMANCE OF IMAGE GLIDE SLOPE ANTENNA IN THE PRESENCE OF TRUNCATED GROUND Interim Report
J. T. Godfrey, R. A. Moore, G. J. Moussally, and H. F. Hartley Mar. 1978 77 p refs
(Contract DOT-FA74WA-3353)
(AD-A054415; FAA-RD-78-43) Avail: NTIS HC A05/MF A01 CSCL 09/1

An analysis was performed to permit the calculation of fields of dipoles at any orientation over lateral or transverse conducting half planes and over multiple contiguous strips of arbitrary tilt angle. Computer programs were developed to calculate DDM over terrain types from half planes and strips. Glide path DDM calculations over typical terrain types for the three image type glide slope systems were computed. G.Y.

N78-28297# Electromagnetic Compatibility Analysis Center, Annapolis, Md.
AN EMC ANALYSIS OF THE PROPOSED ASDE-3 AIRPORT SURFACE DETECTION EQUIPMENT RADAR Final Report, Apr. - Nov. 1976
J. G. Preis, Jr. (IIT Res. Inst., Annapolis) and T. Malicka (IIT Res. Inst., Annapolis) Dec. 1977 63 p refs
(Contracts DOT-FA70WAI-175; F19628-78-C-0006)
(AD-A054607; ECAC-PR-76-078; FAA-RD-77-183) Avail: NTIS HC A04/MF A01 CSCL 17/9

The electromagnetic compatibility between airport surface detection equipment (ASDE-3) radars to be located at major U.S. commercial airports and the communications-electronics equipments near proposed ASDE-3 sites are studied. Three types of the environmental equipment are considered: ground-based equipment, aircraft landing systems, and airborne equipments. Predicted interfering signal levels were compared against established receiver interference thresholds to determine interference problems, and frequency management techniques were identified as potential solutions to the problems. It is determined that the recommended solutions are applicable regardless of whether ASDE-3 operates in the single-frequency or the frequency-agile mode. G.G.

N78-28298# Federal Aviation Administration, Washington, D. C.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: FREQUENCY SPECTRUM MANAGEMENT
Apr. 1978 34 p refs
(AD-A054606; FAA-ED-21-4) Avail: NTIS HC A03/MF A01 CSCL 17/2

Management activities supporting aviation's use of the frequency spectrum are described. Long range spectrum planning is provided through coordination with national and international organizations. Policy, criteria, and standards were detailed to spectrum users to ensure efficient spectrum utilization. Electromagnetic compatibility analyses and representation in national/international forums were used to ensure the suitability of available spectrum. New measurement and analysis techniques are provided to improve overall spectrum management. G.G.

N78-28299*# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
AMPLITUDE SCINTILLATION AT 2 AND 30 GHz ON EARTH SPACE PATHS
D. B. Hodge, D. M. Theobold, and D. M. J. Devasirvatham Feb. 1977 9 p refs
(Contract NAS5-22575)
(NASA-CR-156780; Rept-4299-3) Avail: NTIS HC A02/MF A01 CSCL 20N

Extensive amplitude scintillation measurements were made simultaneously at 2.075 and 30 GHz on earth-space propagation paths. These measurements were performed as the Applications Technology Satellite (ATS-6) was moved slowly from a synchronous position over India to a new synchronous position over the United States. The variance, path loss, covariance, and spectra are discussed as functions of the path elevation angle. These results are also compared with earlier simultaneous scintillation measurements at 20 and 30 GHz during the movement of ATS-6 to its position over India. G.Y.

N78-28300*# Ohio State Univ., Columbus. ElectroScience Lab.
METEOROLOGICAL RADAR CALIBRATION
D. B. Hodge Feb. 1978 18 p refs
(Contract NAS5-23850)
(NASA-CR-156797; ESL-784650-1) Avail: NTIS

HC A02/MF A01 CSCL 17I

A meteorological radar calibration technique is developed. It is found that the integrated, range corrected, received power saturates under intense rain conditions in a manner analogous to that encountered for the radiometric path temperature. Furthermore, it is found that this saturation condition establishes a bound which may be used to determine an absolution radar calibration for the case of radars operating at attenuating wavelengths. In the case of less intense rainfall or for radars at nonattenuating wavelengths, the relationship for direct calibration in terms of an independent measurement of radiometric path temperature is developed. This approach offers the advantage that the calibration is in terms of an independent measurement of the rainfall through the same elevated region as that viewed by the radar. G.Y.

N78-28301*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPTIMAL SAMPLING AND QUANTIZATION OF SYNTHETIC APERTURE RADAR SIGNALS
Chialin Wu 15 Jun. 1978 43 p refs
(Contract NAS7-100)
(NASA-CR-157339; JPL-Pub-78-41) Avail: NTIS HC A03/MF A01 CSCL 17I

Some theoretical and experimental results on optimal sampling and quantization of synthetic aperture radar (SAR) signals are presented. It includes a description of a derived theoretical relationship between the pixel signal to noise ratio of processed SAR images and the number of quantization bits per sampled signal, assuming homogeneous extended targets. With this relationship known, a solution may be realized for the problem of optimal allocation of a fixed data bit-volume (for specified surface area and resolution criterion) between the number of samples and the number of bits per sample. The results indicate that to achieve the best possible image quality for a fixed bit rate and a given resolution criterion, one should quantize individual samples coarsely and thereby maximize the number of multiple looks. The theoretical results are then compared with simulation results obtained by processing aircraft SAR data. G.Y.

N78-28302*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RPV APPLICATION OF A GLOBALLY ADAPTIVE RATE CONTROLLED COMPRESSOR
Robert F. Rice 15 Jul. 1978 25 p refs Prepared for Army Aviation Research and Development Command, St. Louis, Mo.
(Contract NAS7-100)
(NASA-CR-157343; JPL-Pub-78-61) Avail: NTIS HC A02/MF A01 CSCL 17B

A globally adaptive image compression structure is introduced for use in a tactical RPV environment. The structure described would provide an operator with the flexibility to dynamically maximize the usefulness of a limited and changing data rate. The concepts would potentially simplify system design while at the same time improving overall system performance. G.Y.

N78-28303*# RCA Service Co., Inc., Patrick AFB, Fla.
S-BAND RADAR CALIBRATION TEST OF THE LIGHTNING DETECTION AND RANGING SYSTEM (LDAR)
Horst A. Poehler 1 Jun. 1978 68 p refs
(Contract NAS10-9130)
(NASA-CR-154627; RCA-620-500) Avail: NTIS HC A04/MF A01 CSCL 17I

A calibration and an accuracy assessment of the Lightning Detection and Ranging System (LDAR) were attempted through a simultaneous track of an S Band radar transponder and a lightning simulator carried by the NASA 6 airplane on a test flight. Included in the report are the results of the calibration test, error analyses of the radar, and the LDAR systems, and recommendations for future calibration tests. Author

N78-28304# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MODEL LOSSES IN UNSTABLE RESONATORS WITH ROUNDED EDGES
Carlos Santana and L. B. Felsen (Polytech. Inst. of N.Y., Brooklyn) Sep. 1977 29 p refs Submitted for publication Sponsored in part by Brazilian Res. Council
(Grant AF-AFOSR-3192-77)
(INPE-1117-PE/086) Avail: NTIS HC A03/MF A01

The waveguide approach to unstable resonators is employed for determining the eigenmode losses in unstable two-dimensional and three-dimensional resonators with perfectly reflecting round-edged mirrors. It is found that edge rounding in cylindrical mirror configurations leads to mode detachment at lower Fresnel numbers than for the sharp-edged case and that the loss behavior approaches more closely the geometric optical limit for infinite mirrors. Similar effects are observed in resonators with circular mirrors, where mode detachment does not occur at all when the mirror edges are sharp. It is also shown that edge rounding improves the separation between the low loss detached mode and the next higher order modes. Author

N78-28305# AEL Service Corp., Farmingdale, N. J.
ELECTROMAGNETIC RADIATION SYSTEM (EMRS) FOR SUSCEPTIBILITY TESTING Quarterly Report, 1 Jul. - 30 Sep. 1977
Jack M. VanArsdale Apr. 1978 35 p
(Contract DAAB07-76-C-0332; DA Proj. 1L7-62701-AH-92)
(AD-A053576; AELSC-TR-2; ECOM-76-0332-4) Avail: NTIS HC A03/MF A01 CSCL 14/2

The function of the Electromagnetic Radiation System (EMRS) is to generate electromagnetic energy so as to produce a constant field strength that can be automatically scanned as a function of frequency. The design objective is to cover the frequency range of 30 hertz to 40 gigahertz with field strength intensities up to 200 volts per meter. A stripline approach is described and proposed for use as the field generating device for the lower frequencies. The use of defocused parabolas are proposed for use at the higher frequencies. Also described are system components including; sweep oscillator, power amplifiers, tunable filters and associated control circuitry. Author (GRA)

N78-28306# Electronics Engineering Group (1842nd), Scott AFB, Ill.
ADCOM DEDICATED SECURE VOICE
Charles E. Schmidt and Bruce F. Brignull 6 Apr. 1978 17 p refs
(AD-A053593; Rept-1842-EEG/EETS-TR-78-8) Avail: NTIS HC A02/MF A01 CSCL 17/2

A survey of the ADCOM dedicated secure voice system was conducted by representatives of the 1842 EEG in order to investigate and recommend corrective action for the present system which is no longer logistically supportable and has a quality of voice reproduction not acceptable for operational requirements. Author (GRA)

N78-28307# Ship Structure Committee, Washington, D. C.
A REPORT ON SHIPBOARD WAVEHEIGHT RADAR SYSTEM Final Report
D. Chen (NRL, Washington, D.C.) and D. Hammond (NRL, Washington, D.C.) Apr. 1978 82 p refs
(MIPR-Z-70099-4-43693)
(AD-A053379; SSC-SL-7-13) Avail: NTIS HC A05/MF A01 CSCL 17/9

A microwave shipboard wave-height radar sensor for measuring ocean wave spectra, developed by the Naval Research Laboratory, was installed on the containership S.S. McLean, February, 1975. The sensor's performance, design, and analysis of data for one data run are discussed. The radar system has a 3 centimeters wavelength, 2 nanoseconds pulse width, 100 watts of peak transmitted power, 10,000 pulse per second repetition rate, 2-foot parabola antenna diameter, 7 decibel receiver noise figure, 100 pulses per second equivalent pulse processing rate, and a 1-foot resolution. Results are in reasonable agreement with airborne measurements. Areas for improving the system are also discussed. Author (GRA)

N78-28308# Naval Research Lab., Washington, D. C.
ANALYSIS OF ALTITUDE ERRORS ARISING FROM AREA TARGET RETURNS IN FM ALTIMETERS Interim Report
Jagamohan B. L. Rao and Seth K. Meads Feb. 1978 30 p refs
(AD-A053388; AD-E000133) Avail: NTIS HC A03/MF A01 CSCL 01/4

A theoretical analysis is presented for the errors, in a conventional and servoed slope FM altimeter, caused by the use of finite beamwidth antennas over an area target. In this

analysis, an area target is considered to be a level surface as far as general physical characteristics are concerned, but is 'rough' as far as acting as a backscatterer of energy. Errors in altitude measurements are determined analytically for different terrain models. Error curves are shown as a function of antenna beamwidth. The results show that a positive error exists for both types of altimeters and the error increases with the increase in antenna beamwidth. For a given antenna beamwidth, the servoed slope altimeter has smaller errors compared to those of a conventional FM altimeter, especially when the terrain reflectivity is independent of the incidence angle. The difference between the two altimeters becomes small as the antenna beamwidth decreases. For the case of sea surface as a target, the differences between the two altimeters is negligible and the increase in errors with the increase in antenna beamwidth is small.
Author (GRA)

N78-28309# Mission Research Corp., Santa Barbara, Calif.
MULTIPLE PHASE-SCREEN PROPAGATION ANALYSIS OR DEFENSE SATELLITE COMMUNICATIONS SYSTEM
Progress Report, Nov. 1975 - Sep. 1977
D. L. Knepp Sep. 1977 86 p refs
(Contract DNA001-76-C-0135)
(AD-A053463; AD-E300190; MRC-R-332; DNA-4424T) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report presents and analyzes simulated results for electric field propagation through a thick, extended region of high-altitude striations of electron density. The simulated results correspond to the problem of communication from a DSCS satellite to a ground station at a frequency of 7.5 GHz. Statistical results are presented for S4 scintillation index and intensity correlation length for a power-law and an exponential phase-screen PSD for values of phase standard deviation ranging from 1 to 100 radians and phase correlation length ranging from 1 to 10 km. Examples of specific realizations of the electric field amplitude and phase at the receiver are also shown. These realizations of signal structure are being used in simulations of DSCS receiver operation, reported elsewhere. Author (GRA)

N78-28310# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
A COMPARISON OF DIPOLE AND FINITE ELEMENT MODELS FOR PREDICTING LEAKAGE FIELDS AROUND RECTANGULAR SLOTS IN FERROMAGNETIC MATERIALS
W. Lord, J. M. Bridges, W. Yen, and R. Palanisamy Jan. 1978 49 p refs
(Grant DAAG29-76-G-0249)
(AD-A053495; ARO-13279.1-MS) Avail: NTIS HC A03/MF A01 CSCL 20/3

This technical report describes computer codes generated for the study of dipole and finite element models of magnetic field/defect interactions associated with leakage field methods of nondestructive testing. It is the principal investigator's contention that finite element analysis techniques could be used to develop defect characterization schemes for all electromagnetic methods of nondestructive testing, as well as providing valuable insight into the study of defect signal phenomena. Experimental results are given, showing Hall probe generated leakage field profiles around rectangular slots in a steel bar, and compared with both dipole and finite element model predictions. GRA

N78-28311# California Univ., Los Angeles.
THEORY OF CONTROL AND COMMUNICATION SYSTEMS APPLICABLE TO THE DESIGN OF AEROSPACE SYSTEMS
Final Report, 1973 - 1977
A. V. Balakrishnan Mar. 1977 17 p refs
(Grant AF-AFOSR-2492-73; AF Proj. 2304)
(AD-A053615; AFOSR-78-0846TR) Avail: NTIS HC A02/MF A01 CSCL 17/2

Thirty six publications, four theses, and one report were published during the period of this grant. The research was conducted in the areas of system identification, stochastic control, nonlinear white noise theory, distributed systems, and computing algorithms. Perhaps the item of maximum immediate practical interest to the Air Force is in the area of Aircraft Flight Testing where flight test data from a Lockheed Jet Star was processed to extract stability and control derivatives as well as the intensity of the turbulence, demonstrating a new technique for handling flight data containing large gust response components.
Author (GRA)

N78-28312# Naval Ocean Systems Center, San Diego, Calif.
CHANNEL ADAPTIVE RECEIVER TEST-BED, SOFTWARE-CONTROLLED HARDWARE FOR STUDYING UNDERWATER ACOUSTIC COMMUNICATION RECEIVERS USES AN ADAPTIVE FILTER AND CAN EMULATE OTHER ADAPTIVE SYSTEMS Interim Report
M. D. Juniper 19 Jan. 1978 36 p refs
(XF21221091)
(AD-A053554; NOSC/TD-141) Avail: NTIS HC A03/MF A01 CSCL 17/2

This document describes a software-controlled experimental test-bed designed primarily to implement a receiver for underwater acoustic communications. It is also useful in evaluating the feasibility of incorporating adaptive filtering in various other signal processing systems. A least-mean-square filter provides the major source of processing; a minicomputer and peripheral devices are used for the transfer, storage, input, and output of data. Concurrent Pascal is used to implement a flexible user-specified real-time operating system. Author (GRA)

N78-28313# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
MESSAGE TECHNOLOGY RESEARCH AND DEVELOPMENT
Quarterly Progress Report, 2 Jul. - 2 Oct. 1977
J. Burchfiel and T. Myer Mar. 1978 36 p refs
(Contract MDA903-76-C-0212; ARPA Order 3161)
(AD-A053552; BBN-3782; QPR-7) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes BBN efforts in the continuing development of the HERMES message-processing system, with respect to system design, security requirements and preparations for the DARPA/NAVY/CINCPAC interactive test. Author (GRA)

N78-28314# Rome Air Development Center, Griffiss AFB, N.Y.
PROCEEDINGS OF THE RADC SPECTRUM ESTIMATION WORKSHOP
May 1978 295 p refs Presented at Griffiss AFB, N. Y., 24-26 May 1978
(AD-A054650) Avail: NTIS HC A13/MF A01 CSCL 14/2

This workshop provided a means for key researchers in the field to describe their work and also provided a means for comparing the work of various researchers using a common data base for representative problems of importance to the Air Force. This report is a collection of papers that were submitted for presentation at RADC's Spectrum Estimation Workshop held 24-26 May 1978 at Griffiss Air Force Base, N. Y. 13441. The papers were published as received by RADC and have not been edited. Further, publication of these papers does not represent approval or endorsement by the Rome Air Development Center or the U.S. Air Force. The researchers were also presented with a set of sample problems called the Spectral Estimation Experiment. The object of this experiment was to establish a basis for comparison of the wide variety of techniques available as a function of selected applications on both real and artificial data sets representing specialized problem classes which are of interest to the government. The common data base offers several additional advantages. Three different problems have been formulated by the workshop committee. They fall generally into the areas of radar, pattern recognition and system identification. The detailed description of the problem and the solutions as determined by the many different algorithms employed will be published separately. Author (GRA)

N78-28315# Sandia Labs., Albuquerque, N. Mex.
DIGITAL SIGNAL PROCESSING AT GEND'S DATA CENTER
J. E. Jackson 1977 778 p Presented at Digital Signal Processing Symp., Albuquerque, New Mexico, 6 Dec. 1977
(SAND-77-1845C) Avail: NTIS HC A99/MF A01

The conversion and recording of analog signals in digital form has been done at the General Electric Neutron Devices Department (GEND) since 1966. The first computerized data system for these digitized wave forms was implemented about two years later. The evolution and integration of these activities at GEND are reported. With the tester-data center interface as a starting point, previous approaches, current capabilities, near

term trends, and future requirements are discussed under the headings the product tester digitizing process, process, product tester/data center considerations-- format, media, and throughput, and data center activities (storage and retrieval, maintenance, display and analysis, and transmission). Author (ERA)

N78-28316# Florence Univ. (Italy). Ist. di Elettronica.
MULTIPLE BURST ERROR CORRECTING CODES
G. Benelli Apr. 1977 25 p refs
(R-7-77) Avail: NTIS HC A02/MF A01

Following the derivation of lower and upper bounds for the redundancy of block-codes, results on block-codes for correcting s bursts for codewords are presented. Comparisons between multiple and single burst error correcting codes show the interest of the first type of codes. A new class of codes, able to correct two bursts for codewords, is also presented. These codes have the advantage of a very simple and fast decoding algorithm. In many cases these codes require a lower redundancy than similar classes of codes. Author (ESA)

N78-28317# Koninklijke/Shell-Laboratorium, Amsterdam (Netherlands).
RADAR DATA EXTRACTION. AN ERGONOMIC EVALUATION OF THE IOTRON DIGIPLOT ON BOARD SS 'METHANE PRINCESS'
W. C. vandenHoed, P. A. Vroon, and H. J. G. Zwaga 1976 68 p refs
(AMSR.0043.75) Avail: NTIS HC A04/MF A01

The operation value of computerized automatic plotters and their usefulness as data extractors of the calculation of sophisticated danger functions in marine navigation, was assessed. Results are presented of an ergonomic evaluation, performed onboard SS 'Methane Princess', in which special attention was paid to the decision methods used by the navigator in avoiding collisions. Author (ESA)

N78-28318# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
INVESTIGATION OF THE STATISTIC PROPERTIES OF TROPOSCATTER CHANNELS FOR THE APPLICATION OF ADAPTIVE EQUALIZERS [UNTERSUCHUNG DER STATISTISCHEN EIGENSCHAFTEN VON TROPOSCATTERKANAELEN IM HINBLICK AUF DEN EINSATZ ADAPTIVER LAUFZEITENTZERRER]
F. Schmitt Aug. 1977 36 p refs In GERMAN; ENGLISH summary
(Contract BMVg-GF76/77)
(Rept-3-77) Avail: NTIS HC A03/MF A01

Results of measurements of some link parameters of a 280 km troposcatter link (frequency 0.9 GHz, bandwidth 10 MHz) are presented. These are of importance for adaptive equalizing techniques: characteristic of the delay power spectrum (DPS) and its variance; characteristic of the instantaneous channel impulse response and its time dependence; effects of airplanes inside and outside the common scattering volume; and correlation analysis between DPS, received field strength, and intermodulation. Although the results confirm the (stationary) WSSVS-model of the troposcatter channel in general, the measured DPS often showed significant deviations from the theoretically calculated one with respect to its duration and shape. The latter therefore is in some cases not a good basis for deciding on the length of the equalizing filter. Author (ESA)

N78-28319# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
A DIGITAL FILTER FOR ADAPTIVE SPATIAL NOISE SUPPRESSION [EIN DIGITALES FILTER ZUR ADAPTIVEN RAEUMLICHEN STOERUNTERDRUECKUNG]
R. Klemm Mar. 1977 57 p refs In GERMAN; ENGLISH summary
(FFM-258) Avail: NTIS HC A04/MF A01

The development of a digital filter for adaptive spatial jammer suppression is described. The steepest descend algorithm was used. The filter was computer simulated in complex binary arithmetic. Conclusions concerning the behavior of the filter (convergence, suppression of interference) dependent on system parameters (loop factor, quantization, number of loops) and on the number of independent interfering sources are presented. Author (ESA)

N78-28320# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
STRUCTURE OF THE CENTRAL PROCESSOR SOFTWARE OF THE ELRA-SYSTEM
R. Baltes and G. VanKeuk Nov. 1977 79 p refs In GERMAN; ENGLISH summary
(FFM-261) Avail: NTIS HC A05/MF A01

The structure of the large software system used for multi-target-tracking and central control of an electronically steered radar, ELRA, is described. Author (ESA)

N78-28321# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
PROBLEMS OF COMPUTER AIDED RADAR TARGET TRACKING TEMPORARILY BASED ON ANGLE INFORMATION ONLY
H.-J. Mieth Dec. 1977 67 p refs In GERMAN; ENGLISH summary
(FFM-262) Avail: NTIS HC A04/MF A01

Given a point of time after which especially range and Doppler information of a radar will be jammed and the remaining information can be taken as bearings, the problem of supporting an already conducted track past the initial point of jamming within certain bounds was considered. Under some additional assumptions (especially of a deterministic kind) an estimate, sharp in some cases, of all points reachable from the position at the initial point of jamming was given with respect to all direction findings thereafter. The whole analysis was done on the essential premises that only one fixed radar is available for direction finding and bounds of the maneuverability with respect to the target are known. Author (ESA)

N78-28111*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEEP SPACE NETWORK TO VIKING ORBITER TELECOMMUNICATIONS PERFORMANCE DURING THE VIKING EXTENDED MISSION, NOVEMBER 1976 - FEBRUARY 1978
F. H. J. Taylor *In its* The Deep Space Network 15 Jun. 1978 p 7-34 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

N78-28113*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 DEEP SPACE NETWORK TELECOMMUNICATIONS COMPATIBILITY TEST PROGRAM STATUS
A. I. Bryan and R. P. Kemp *In its* The Deep Space Network 15 Jun. 1978 p 39-100 (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

N78-28115*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A DEMONSTRATION OF DIFFERENCED DUAL-STATION ONE-WAY DOPPLER CONDUCTED WITH PIONEER 11
C. C. Chao, V. J. Ondrasik, and H. L. Siegel *In its* The Deep Space Network 15 Jun. 1978 p 104-110 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

N78-28119*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON ESTIMATING THE PHASE OF A PERIODIC WAVEFORM IN ADDITIVE GAUSSIAN NOISE, PART 1
L. L. Rauch *In its* The Deep Space Network 15 Jun. 1978 p 152-164 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 20N

N78-28124*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXAMINATION OF THE DSN X-BAND WEATHER SPECIFICATION
In its The Deep Space Network 15 Jun. 1978 p 197-208 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

N78-28126*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CCIR PAPER ON THE RADIOCOMMUNICATIONS REQUIREMENTS FOR SYSTEMS TO SEARCH FOR EXTRATERRESTRIAL LIFE

D. Nightingale *In its* The Deep Space Network 15 Jun. 1978 p 224-244 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

N78-28131*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPLEMENTATION OF THE RADIO SCIENCE SUBSYSTEM IN THE DSN
K. R. Kimball *In its* The Deep Space Network 15 Jun. 1978 p 282-287 (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N78-28322 British Library Lending Div., Boston Spa (England).
SHIELDING
J. Allesen-Holm 30 Jun. 1977 29 p refs Transl. into ENGLISH from Teletek. (Den.), v. 27, no. 3/4 1976 p 153-166
(BLL-Trans-3476-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

The theory for shielding from magnetic and electromagnetic fields is reviewed, and formulas for the calculation of reduction factors are set up. The protective measures, which may be chosen to eliminate the noise fields that may interfere with telephone networks in this case, also shielding, are given. G.Y.

N78-28323 British Library Lending Div., Boston Spa (England).
DETERMINING THE RELIABILITY OF UNPROTECTED CONTACTS
G. Peter 8 Nov. 1977 10 p Transl. into ENGLISH from Radio Fernsehen Elektron. (West Germany), v. 25, no. 7, 1976 p 214-215
(BLL-Trans-3489-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

One of the most important and at the same time most problematic of components used in the switching theory is the unprotected contact. This report discusses ways in which work on the reliability of unprotected contacts can contribute to the solutions of the following problems: (1) high cost of maintenance due to increases in environmental pollution; (2) lowering maintenance cost despite the increasing extent of installations; (3) developing materials which meet the optimal requirements made of them and are at the same time as economical as possible; (4) increasing number of contacts participating in a switching function. G.Y.

N78-28324 British Library Lending Div., Boston Spa (England).
THE PRINCIPLES OF CRIMPED AND WRAPPED JOINTS
H. Schmidtke 20 Jul. 1977 20 p Transl. into ENGLISH from Elektroniker, no. 3, 1976 p 27-32
(BLL-Trans-3490-(7737.47); BLL-Trans-3490) Avail: British Library Lending Div., Boston Spa, Engl.

This essay deals with a part of solderless connection technology. Preference is given to those technologies which undoubtedly represent pioneering achievements in the field of modern connection technology. This essay was written in order to help the younger generation in the profession to obtain a firm theoretical basis for any practical experience. Major topics addressed are: (1) the compression or pressing method (crimped joints); and (2) wire wrap connections. G.Y.

N78-28325 British Library Lending Div., Boston Spa (England).
A REVIEW OF CLIMATIC TESTING SPECIFICATIONS FOR ELECTRO-TECHNICAL EQUIPMENT
H. D. Frisch 20 Jul. 1977 12 p refs Transl. into ENGLISH from Qualitat und Zuverlassigkeit (Germany), vol. 21, no. 1, Jan. 1976 p 7-10
(BLL-Trans-3491-(7737.47); BLL-Trans-3491) Avail: British Library Lending Div., Boston Spa, Engl.

Instruments and equipment are affected by the climate. Equipment and instrument behavior must be tested under typical climatic conditions or in special environmental rooms. Environmental rooms are preferred because they offer the advantage of good reproducibility and make it possible to use a higher load for a correspondingly shorter test time. Climatic tests under humid warmth conditions carried out in environmental rooms are described. G.Y.

N78-28326 British Library Lending Div., Boston Spa (England).
FLAT DISPLAY
W. Veith 20 Jul. 1977 12 p refs Transl. into ENGLISH from Nachrichtentech. Z. (West Germany), v. 30, no. 3, Mar. 1977 p 219-222
(BLL-Trans-3500-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

Work is being done on the flat display, but it should be admitted at the outset that it certainly does not exist for the purpose of practical use. A number of techniques of which few only promise to be successful are considered in this report. The techniques discussed are: (1) semiconductor display; (2) electroluminescence screen; (3) liquid crystal display; and (4) plasma display. G.Y.

N78-28327 British Library Lending Div., Boston Spa (England).
PROBLEMS WITH THE MEASUREMENTS OF ANALOGUE INTEGRATED CIRCUITS
S. Angee and P. Prodhomme 8 Sep. 1977 3 p Transl. into ENGLISH from Onde Elec. (France), no. 3, 1977 p 236-238
(BLL-Trans-3515-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

A classification of parameters and circuits is given, first of all to show the common points and secondly to show the order of magnitude of the values to be measured. Measurements require that certain general precautions be taken, applicable to most measurements. In addition, there are different techniques for automatic and for manual measurements, and the advantages and disadvantages of each are set out for a large number of measurable parameters. G.Y.

N78-28328 British Library Lending Div., Boston Spa (England).
RELIABILITY ASSESSMENT OF A 4-KILOBIT n-CHANNEL MOS RAM AND CLOCK DRIVER
Y. Watanabe, T. Mizusawa, Y. Sakagawa, and K. Masuda 8 Nov. 1977 28 p refs Transl. into ENGLISH from Kenkyu Jitsuyoka Hokoku (Japan), v. 25, no. 8, 1976 p 1269-1280
(BLL-PO-Trans-3536-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

An evaluation of the design and fabrication of the elements from the initial development stage is presented so as to elicit and solve any problems to do with reliability. Annual fluctuations of the characteristic values over 22 years were also investigated and an initial standard was set up on the basis of these. In anticipation of the beginning of safe batch production, large scale reliability tests were carried out by random sampling and the results showed that it is possible to fulfill the stringent reliability conditions of electronic switching systems. G.Y.

N78-28329 British Library Lending Div., Boston Spa (England).
PREDICTION OF SOLDERING FAULTS IN ELECTRONIC ASSEMBLIES
P. Bartsch 14 Nov. 1977 16 p refs Transl. into ENGLISH from Fernmeldetechnik (West Germany), v. 16, no. 6, 1976 p 193-197
(BLL-PO-Trans-3542-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

More than 15,000 two level circuit boards were examined in respect of the causes of fault in the assembly and soldering process. The soldering fault probability during assembly and soldering stage is determined by a production test procedure. This prediction permits intervention of a corrective procedure and, therefore, stabilization in the technological process when predetermined set value is likely to be exceeded or inadequate. G.Y.

N78-28330 British Library Lending Div., Boston Spa (England).
ON COMPUTER ASSISTED NOISE ANALYSIS OF ELECTRONIC SWITCHING

H. Schreiber and R. Boehme Feb. 1978 13 p refs Transl. into ENGLISH from Nachrichtentechnik Elektronic (East Germany), v. 26, no. 6, 1976 p 207-210
(BLL-RTS-10556) Avail: British Library Lending Div., Boston Spa, Engl.: 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

A rational computer analysis process is described for determining the transfer factors of noise sources at the output terminals of electrical networks. The direct numerical calculation involves the use of the sparse matrix technique and advantageous splitting of the matrix to be inverted. By comparing the individual noisy switching elements, dominant noise sources can be identified. An active RC filter (bandpass of the 8th grade) in cascade technique is used to demonstrate how to optimize by changing a series of filter components with constant filter characteristics. A.R.H.

N78-28331 British Library Lending Div., Boston Spa (England).
ON ARMATURE WINDING ANALYSIS FOR A SMOOTH-ARMATURE ELECTRICAL MACHINE
S. S. Kiselev Mar. 1978 11 p refs Transl. into ENGLISH from Latv. PSR Zinat. Akad. Vestis (USSR), v. 2, 1969 p 115-120
(BLL-RTS-10634) Avail: British Library Lending Div., Boston Spa, Engl.: 7 BLL overseas, 8 European or 30 BLL UK photocopy coupons

Special features of a one-position armature winding for an electrical machine with smooth armature are examined to introduce a practical method for analysis of armature coil geometry and its feasibility conditions. Formulae are derived for calculating the width of the commutation zone and the asymmetry of the zone in relation to the line of geometric neutral. The result obtained by the formula for the width of the commutation zone is compared with the result of calculating the width of the commutation zone for a two-position winding of an armature with teeth. The analysis is performed for armatures of the same dimensions and with the same number of armature coils and commutator segments. Comparison of the results shows the width of the commutation zone to be much less for the one-position winding of the smooth armature. This is confirmed also by data obtained in experimental research. Author

N78-28332 British Library Lending Div., Boston Spa (England).
THE ELECTROMOTIVE FORCE OF WINDINGS OF SLOTLESS DIRECT CURRENT COMMUTATOR MACHINES
M. Z. Zhits Jan. 1978 8 p refs Transl. into ENGLISH from Elektrichestvo (USSR), no. 1, 1973 p 40-42
(BLL-RTS-10637) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

A general formula is proposed for the e.m.f. across the brushes and the intersegment voltage in armature windings of slotless machines. The formula enables a number of important parameters of these windings to be determined for any shortening of the pitch and any value of the commutator segment pitch. A drum armature with 24 active conductors uniformly distributed around the armature perimeter was considered. B.B.

N78-28333 British Library Lending Div., Boston Spa (England).
NEW TECHNOLOGIES FOR SILICON POWER DEVICES. RECOMBINATION IN HEAVILY DOPED EMITTER REGIONS
H. Schlangenotto Mar. 1978 126 p refs Transl. into ENGLISH from West German Report, BMFT-BT-T-76-54, 1975 126 p
(BLL-RTS-10822) Avail: British Library Lending Div., Boston Spa, Engl.: 14 BLL overseas, 15 European or 60 UK BLL photocopy coupons

An attempt was made at a more accurate investigation of the extent to which, by reducing the remitter recombination, the forward and recovery time characteristics of thyristors and rectifiers can be fundamentally improved and the degree in which this objective is technologically attainable. This includes the investigation of the extent to which the remitter recombination is dependent on production conditions, a dependence on which power devices are concerned. G.Y.

N78-28334 British Library Lending Div., Boston Spa (England).
FERRITE-CORED POWER TRANSFORMERS FOR SWITCH-MODE POWER PACKS
R. Friedrich and G. Roespel Jan. 1978 9 p refs Transl. into ENGLISH from J. of Magnetism and Magnetic Mater. (West Germany), v. 4, no. 1-4, 1977 p 129-133
(BLL-RTS-10922) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Switched power packs are fairly well established as the power supply of electronic instruments. These transformers are successfully equipped with ferrite cores. The interdependence of ferrite properties, construction, size, and transferable power of the transformer are discussed. Optimal inductions, thermal resistances, and transferable powers at different operation modes, are given for power transducers equipped with special core types. G.Y.

N78-28335 British Library Lending Div., Boston Spa (England).
SPECIAL FERRITE CORES FOR SWITCH-MODE POWER PACKS
K. Ruschmeyer Jan. 1978 11 p Transl. into ENGLISH from J. Magnetism Magn. Mater. (West Ger.), v. 4, no. 1-4, 1977 p 134-139
(BLL-RTS-10923) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The requirements of ferrite cores for transformers are discussed. Core optimization, and core specification are analyzed by nomographical dimensioning. F.O.S.

N78-28336 British Library Lending Div., Boston Spa (England).
TWO-DIMENSIONAL TIME ANALYSIS OF INHOMOGENEOUS DISTRIBUTED RC-STRUCTURES
R. Muller Mar. 1978 7 p refs Transl. into ENGLISH from Nachrichtentechnik elektronik, v. 27, no. 4, 1977 p 172-173
(BLL-RTS-11112) Avail: British Library Lending Div., Boston Spa, Engl.: 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Distributed RC-structures consisting of several layers provide filter transmission behavior and take the place of several passive lumped mounting elements. Their two-dimensional time-dependent describing equations were solved numerically in the time interval. The only structures treated were those which can be actualized in thin or thick film technology because their structural parameters are constant quantities. Moreover, only exponential bounding functions are considered because these structures are known from the one-dimensional study to be the best as regards filter behavior. G.G.

N78-28337 Mississippi Univ., University.
A COAXIAL-LINE-DRIVEN SLEEVE MONOPOLE OVER AN INFINITE GROUND PLANE Ph.D. Thesis
Edward Kai-Ning Yung 1977 222 p
Avail: Univ. Microfilms Order No. 7807991

A method is developed for computing the current distribution on a coaxial line driven monopole cylinder over an infinite ground plane and the tangential electric field at the opening of the connecting coaxial line through which the antenna is excited. The theory is extended to treat the problem of a coaxial line-driven sleeve monopole above ground. The scheme presented in this dissertation is effective to treat thick antennas whose cylinder radii are as big as a quarter wavelength. The success of the present formulation is mainly due to the correct aperture electric field or magnetic current. The computation of the correct magnetic current implies that the tangential electric field across the annular aperture of a coaxial line-driven antenna is considered as an unknown and is determined from equations resulting from enforcing continuity of the tangential magnetic field across the aperture. Dissert. Abstr.

N78-28338*# Varian Associates, Palo Alto, Calif.
STUDY PROGRAM FOR DESIGN IMPROVEMENTS OF THE X-3060 AND X-3075. PHASE 1: STUDY DEFINITION Final Report
Art Goldfinger Jan. 1978 43 p Prepared for JPL
(Contracts NAS7-100; JPL-954782)
(NASA-CR-157318) Avail: NTIS HC A03/MF A01 CSCL 09A

The existing designs of the X-3060 and X-3075 klystrons were critically examined to determine whether or not realistic redesign goals could be established. Additionally, failure analyses and field failure reports were examined to identify any design weaknesses. Results of this critical analysis indicate that substantial improvements can be made to the overall design of both the X-3060 and X-3075 klystrons. Pertinent and detailed data concerning these improvements are reported herein. G.G.

N78-28339*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
A SIGNAL ATTENUATOR Patent Application
John T. Polhemus (Martin Marietta Aerospace, Denver, Colo.) and Wilbur H. Cash, inventors (to NASA) (Martin Marietta Aerospace, Denver, Colo.) Filed 26 Jul. 1978 10 p
(Contract NAS4-2387)
(NASA-Case-FRC-11012-1; US-Patent-Appl-SN-928137) Avail: NTIS HC A02/MF A01 CSCL 09A

An artifact signal attenuator for a pulse rate sensor is described. The circuit for attenuating background noise signals is connected with a pulse rate transducer which has a light source and a detector for light reflected from blood vessels of a living body. The heart signal provided consists of a modulated dc signal voltage indicative of pulse rate. The artifact signal resulting from light reflected from the skin of the body comprises both a constant dc signal voltage and a modulated dc signal voltage. The amplitude of the artifact signal is greater and the frequency less than that of the heart signal. The signal attenuator circuit includes an operational amplifier for canceling the artifact signal from the output signal of the transducer and has the capability of meeting packaging requirements for wrist-watch-size packages. NASA

N78-28340*# National Aeronautics and Space Administration. Pasadena Office, Calif.
APPARATUS FOR MEASURING SEMICONDUCTOR DEVICE RESISTANCE Patent Application
Walter J. Matzen, inventor (to NASA) (Texas Instruments, Inc., Dallas, Tex.) Filed 23 Jun. 1978 18 p
(Contract NAS7-100)
(NASA-Case-NPO-14424-1; NASA-Case-NPO-144340-1; US-Patent-Appl-SN-918534) Avail: NTIS HC A02/MF A01 CSCL 09A

A test structure for accurately measuring the sheet resistance of the diffused region of a semiconductor during processing is provided. The novel feature is that one of the terminals extends in a closed path around the other terminal so that all current flowing during the resistance measurement flows through only the ring of semiconductor material lying between the terminals. G.Y.

N78-28341# General Electric Co., St. Petersburg, Fla. Dept. of Neutron Devices.
QUARTZ CRYSTAL FABRICATION FACILITY Semiannual Report, 1 Oct. 1976 - 31 Mar. 1977
J. M. Frank and R. J. Ney Nov. 1977 55 p refs
(AD-A053582; GEPP-309; SAR-1) Avail: NTIS HC A04/MF A01 CSCL 09/1

The specification objectives for a high production, in line, ultrahigh vacuum, precision crystal unit final processing system now being constructed are reviewed. Design features of the system including methods for ultraviolet cleaning, bakeout, plating and sealing of crystal units having ceramic flat pack enclosures in an oilfree, cryogenic vacuum system are outlined. Entrance and exit air lock chambers and transports provide means to maintain the critical process chambers at high vacuum continuously. Experimentation to develop and prove several process modules being incorporated into the final system is described and initial results reported. Emphasis is placed on simplicity of design, operational reliability, modular interchangeability, cleanliness, and future automation aspects. Author (GRA)

N78-28342# Northrop Nortronics, Palos Verdes Peninsula, Calif.
THERMIONIC FIELD EMISSION GUN Final Technical Summary Report, 18 May - 31 Dec. 1977
W. Hant Jan. 1978 35 p refs
(Contract N00014-77-C-0469; ARPA Order 3125)
(AD-A053580; NRTC-78-02R) Avail: NTIS HC A03/MF A01 CSCL 09/5

Results are presented for a program to validate the technology for thermionic field emission (TF) guns. TF guns are proposed as an attractive alternate to cold cathode guns as high average and high peak current density excitation sources for repetitively pulsed short wavelength lasers. Among the advantages of TF guns are that they exhibit temporally constant impedance characteristics, are not subject to diode closure restrictions, and utilize well understood and controllable electron trajectories. The latter requirement is critical to the achievement of efficient beam transmission through closely spaced cooled ladder and foil support structures. Major program tasks included: performance of a theoretical analysis to predict the emission characteristics for a diode experiment and to estimate achieveable beam uniformity; development and thermal testing of a filament and support structure suitable for large area guns; and design, construction and experimental evaluation of a small area high voltage TF gun. Author (GRA)

N78-28343# Naval Research Lab., Washington, D. C.
A PHASED ARRAY MAINTENANCE MONITORING SYSTEM, PART 2 Interim Report
James K. Hsiao and J. Paul Shelton Mar. 1978 31 p ref
(Contract DOT-FA75WAI-556)
(AD-A053396; AD-E000137; NRL-MR-3737) Avail: NTIS HC A03/MF A01 CSCL 09/5

Methods for monitoring failures in a COMPACT array are presented. A Fourier transform method can be used to monitor a conventional array, as shown in Part I of this two-part series of reports. It is shown in this report that the same method can be extended to cover a COMPACT array. A one-bit transform method is described in this report which can achieve the same monitoring purpose as that of the Fourier transform method without the necessity of performing complex multiplications in the processor. Simulation of these two approaches indicates that they are adequate to detect and locate failure in both the network and the phase shifters in a COMPACT phased array. Author (GRA)

N78-28344# Florida Univ., Gainesville. Dept. of Materials Science and Engineering.
ELECTRICAL PROPERTIES OF POLYCRYSTALLINE CERAMIC INSULATORS Final Report, 1 Apr. 1975 - 31 Jul. 1977
Ronald E. Loehman, Robert DeHoff, and G. Rama Rao 20 Feb. 1978 115 p refs
(Contract N00014-75-C-0888)
(AD-A053609) Avail: NTIS HC A06/MF A01 CSCL 20/3

An attempt has been made to show the effect of microstructure on electrical properties in several types of idealized polycrystalline ceramic insulators. The concept of the path of microstructural change was used to vary hotpressing or sintering conditions to produce samples of Al_2O_3-porosity and Al_2O_3-SiO_2 with systematically related microstructures. The most detailed quantitative microstructural study yet reported for a ceramic system was made on these samples. Information on volume fractions, surface area, curvatures and lengths of various features shows clearly that classifying specimens only on the basis of density and average grain size, as is commonly done, tends to lump together samples with very different microstructures, thus observing microstructure-porosity relations. Dielectric measurements on Al_2O_3-porosity specimens with similar densities and chemical compositions but different values for the quantitative microscopic variables reveal strong differences in conductivity, dielectric constant and dielectric loss behavior. A qualitative model involving bulk and grain boundary conduction is advanced to explain dielectric data obtained for a series of systematically related Al_2O_3-porosity specimens. A quantitative microscopic investigation of $BaTiO_3$ microstructure to determine if the technique might be useful in understanding ferroelectric aging effects is discussed in the second part of the report. Author (GRA)

N78-28345# General Electric Co., Schenectady, N. Y.
SUPERCONDUCTING ROTOR RESEARCH Interim Technical Report, 1 Nov. 1976 - 31 Jul. 1977
B. B. Gamble, T. A. Keim, and P. A. Rios Nov. 1977 89 p refs

(Contract F33615-76-C-2167; AF Proj. 3145)
(AD-A053612; SRD-77-131; AFAPL-TR-77-68) Avail: NTIS HC A05/MF A01 CSCL 09/3

This report summarizes work completed for the Air Force Aero Propulsion Laboratory in Phase I of a program entitled Superconducting Rotor Research. The objective of this program is to incorporate new materials in the design of an airborne, 20 MW, high-speed, superconducting generator. The rotor of the generator will be constructed and its current density demonstrated. The Phase I work consisted of a sizing study to select the machine configuration and dimensions, a survey of superconducting materials, and selection of the superconductor for this application. Author (GRA)

N78-28346# Tennessee Univ., Knoxville.
LINEAR TIME-DELAY GENERATOR USING ECL TECHNOLOGY M.S. Thesis
Karle L. Severson Dec. 1977 96 p refs
(AD-A053523) Avail: NTIS HC A05/MF A01 CSCL 14/2

The purpose of this research project was to develop a wide-range, linear, time-delay circuit having an output pulse that is compatible with ECL logic levels. The circuit requires an input pulse width of 4 nsec, has a propagation delay of 8 nsec, and has rise and fall times of 2 nsec on the output pulse. The linearity error between the delay generated and the delay dial setting is less than 1%. The output pulse jitter is less than 0.2%. The circuit is retriggerable in 3 nsec. The wide-range, linear, time-delay circuit was developed using ECL technology. The voltage comparison functions were performed by four AM685's which are high-speed ECL voltage comparators. The various logic functions were performed with three MECL integrated circuit chips. One MC10104 IC performed AND and NAND logic functions and two MC10105 IC's performed OR and NOR logic functions. The circuit used a minimum number of discrete components. Author (GRA)

N78-28347# International Business Machines Corp., Hopewell Junction, N. Y. East Fishkill Labs.
DAMAGE PROFILES IN SILICON AND THEIR IMPACT ON DEVICE RELIABILITY Technical Report, 15 Oct. 1976 - 3 Mar. 1977
G. H. Schwuttke Mar. 1977 51 p refs
(Contract N00173-76-C-0303; ARPA Order 3231)
(AD-A053538; TR-22.2090; TR-1) Avail: NTIS HC A04/MF A01 CSCL 20/12

N-type Si was implanted with 200 keV Cs(+) with doses ranging from 10 to the 13th power to 10 to the 15th power ions/sq cm. After nitrogen anneal MOS capacitors were formed by thermal oxidation and Al deposition. Transmission electron microscopy was used to study the residual ion damage. GRA

N78-28348# Oak Ridge National Lab., Tenn.
OPTICALLY COUPLED HIGH VOLTAGE ISOLATION AMPLIFIER
James W. Pearce Feb. 1978 13 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6207) Avail: NTIS HC A02/MF A01

A very high voltage isolation amplifier was designed. It employs analog-to-digital conversion with serial data transmission on a fiber optic cable. ERA

N78-28349# Sandia Labs., Albuquerque, N. Mex.
INTERACTION OF THICK FILM DIELECTRIC, CONDUCTOR, AND ALUMINA SUBSTRATE FOR DCU201 AIRCRAFT CONTROLLER
Sharon S. White Feb. 1978 27 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0069) Avail: NTIS HC A03/MF A01

A multilayer thick film system committed for use in the DCU201 aircraft controller was examined by stress, electron microprobe, X-ray, wet chemical, and insulation resistance analyses. Even after rigorous multilayer processing, which requires up to eight firings of portions of the system, no problems were discerned in the areas of stress distribution, materials diffusion between different layers, and electrical conduction within dielectric layers. ERA

N78-28350# Los Alamos Scientific Lab., N. Mex.
TYPICAL VIDICON RESPONSES TO SHORT-DURATION PULSED LIGHT AND FAST SINGLE-FIELD READOUT
George J. Yates and V. H. Holmes, Jr. Mar. 1978 30 p
(Contract W-7405-eng-36)
(LA-7026) Avail: NTIS HC A03/MF A01

The use of television cameras for recording analog data from diagnostic experiments prompted the characterization of several key features of various vidicon pickup tubes. These features include the responses to short-duration high intensity pulsed light sources under single field and variable scan rate readout conditions. Dynamic range, resolution, writing, and reading characteristics such as speed and lag, reciprocity, and signal-to-noise characteristics were investigated to optimize the cameras for use as reliable data acquisition instruments. ERA

N78-28351# Sandia Labs., Albuquerque, N. Mex.
ALUMINUM WIRE TO THICK FILM CONNECTION [FOR] HIGH TEMPERATURE OPERATION
D. W. Palmer and F. P. Ganyard 1977 15 p Presented at IEEE Proc. Electron. Components Conf., Anaheim, Calif., 24 Apr. 1978
(Contract EY-76-C-04-0789)
(SAND-77-1711C; Conf-780416-1) Avail: NTIS HC A02/MF A01

Hybrid microcircuits in geothermal instrumentation must operate from room temperature to 300 C. High temperature operation initially caused aluminum wire-to-gold composition bond problems. To remedy this problem two wire bonding techniques were qualified in high temperature aging tests: (1) ultrasonic bonding of aluminum wire directly to modified fritless gold conductor inks and (2) insertion of a 1 mil diffusion barrier pad between the thick film and the aluminum wire. Both systems allow 100 to 1000 hours of geothermal circuit operation at 300 C. Three alloys of wire were tested: pure aluminum, aluminum with 1% silicon, and aluminum with 1% magnesium. The degradation rates differed greatly, with pure aluminum being the least tolerant to temperature aging and wire with 1% silicon faring the best. ERA

N78-28352# Argonne National Lab., Ill.
EFFECTS OF CYCLIC STRAINS ON TRANSPORT PROPERTIES OF A SUPERCONDUCTING COMPOSITE: PHASE 1, DEGRADATION OF ELECTRICAL CONDUCTIVITY IN COPPER AT 4.2 K
F. S. Fisher, S. H. Kim, R. J. Linz, and A. P. L. Turner Aug. 1977 42 p
(ANL-77-50) Avail: NTIS HC A03/MF A01

Aspects of superconducting composites for magnetic fusion applications are discussed. ERA

N78-28353# Central Electricity Generating Board, London (England).
MODIFIED ELECTRODE SUPPORT/TERMINATION SYSTEM FOR ELECTROSTATIC PRECIPITATORS
T. Kirby Feb. 1977 6 p
(TDB-273) Avail: NTIS HC A02/MF A01

An electrostatic precipitator for the removal of solid particles from gases, for example flue gases, is presented. Each electrode comprises a number of wires held under tension in a framework. The electrode wire, of asteroid section, is encapsulated in its sleeve at one end with epoxy resin. The system provides a hermetic seal around the wire, damps any mechanical vibration, and separates the electrical and mechanical connections in order to prevent electrical erosion at the terminations. Author (ESA)

N78-28354# Central Electricity Generating Board, London (England).
SUPERCONDUCTING DISC ALTERNATOR
R. V. Harrowell Aug. 1977 10 p refs
(TDB-284) Avail: NTIS HC A02/MF A01

A preliminary study of a superconducting alternator with a rotating disc armature was made. The field winding is a superconducting toroid with diametrically opposite gaps in which the disc armature rotates. The major advantages of such a machine are: (1) the stationary field winding can be easily cooled to 4.2 K, and it can also be supported against torque forces without the difficulties associated with a rotating field winding; (2) the field winding does not produce significant stray magnetic fields;

(3) it is an inherently low-cost machine; (4) intermediate shaft bearings can be incorporated, thus permitting scaling up by an increase in machine length; and (5) a 500 MW machine would weigh less than 100 tons. The chief disadvantage of such a generator is the need for high-current, high voltage brushes, and slip rings. Three possible systems of current collection are reviewed. The chances of producing a viable system are good.
Author (ESA)

N78-28355# Florence Univ. (Italy). Ist. di Elettronica.
TIME DOMAIN SYNTHESIS OF ELECTRIC NETWORKS. COMPARISON BETWEEN THIS APPROACH AND THE CLASSICAL FREQUENCY DOMAIN METHODS [SINTESI DI RETI ELETTRICHE NEL DOMINIO DEL TEMPO. CONFRONTO FRA QUESTO TIPO DI APPROCCIO ED I METODI CLASSICI OPERANTI NEL DOMINIO DELLA FREQUENZA]
Paolo Barbini 1976 26 p refs In ITALIAN
(R-8-76) Avail: NTIS HC A03/MF A01

A method is described for the synthesis of networks of passive reciprocal and nonreciprocal m-ports operating in the time domain, i.e., using state variables. This type of approach was not used in the past since it led to difficult matrix calculus problems. The advent of fast computers, however, has changed the situation. A comparison is made between the frequency and time domain approach, pointing out the differences and advantages of one over the other. ESA

N78-28356# Florence Univ. (Italy). Ist. di Elettronica.
STABILITY OF TWO-DIMENSIONAL DIGITAL FILTERS [LA STABILITA NEI FILTRI NUMERICI BIDIMENSIONALI]
M. Bernabo, V. Cappellini, and P. L. Emiliani Feb. 1977 49 p refs In ITALIAN
(R-3-77) Avail: NTIS HC A03/MF A01

The stability problem of recursive two-dimensional digital filters is discussed, and some of the most widely used methods for testing the stability are presented. If the test result is negative, some coefficients of the filters need to be modified. These stabilization methods are also described. ESA

N78-28357# Florence Univ. (Italy). Ist. di Elettronica.
COMMENTS ON MULTIPARAMETRIC SENSITIVITY IN ACTIVE RC NETWORKS
P. Barbini, A. Liberatore, and G. Mazzoni 1977 5 p refs
(R-10-77) Avail: NTIS HC A02/MF A01

A new sensitivity measure based on the study of the rms value of Delta T/T has been defined. To demonstrate that the operation of the integration over the frequency range of interest, which considerably complicates computations, is not significant, it is shown that it is only necessary to compute the expression under the integretion sign for the different circuits. Author (ESA)

N78-28358# Florence Univ. (Italy). Ist. di Elettronica.
COMMENTS ON AN APPROACH TO THE SENSITIVITY AND STATISTIC VARIABILITY OF BIQUADRATIC FILTERS
P. Barbini, A. Liberatore, and G. Mazzoni 1977 8 p refs
(R-11-77) Avail: NTIS HC A02/MF A01

Some considerations and generalizations on the results reached in the Hilberman paper on biquadratic filters are discussed with regard to the multiparametric statistical sensitivity coefficients, for filters of any order. Author (ESA)

N78-28359# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazioni.
A METHOD TO PRODUCE LARGE-SIZED MASTERS FOR PRINTED CIRCUIT SPARK CHAMBERS
P. Gricia, R. Orlando, and P. Veneroni 1 Jun. 1977 12 p ref
(ISS-T-77/5) Avail: NTIS HC A02/MF A01

The production of large-sized films with a set of equally spaced parallel lines is described. These are used for constructing large spark chambers using the printed circuit board technique.
Author (ESA)

N78-28360# Central Electricity Generating Board, London (England).
A TRIGGERED CO-ORDINATING GAP FOR METALCLAD SUBSTATIONS
B. F. Hampton and R. J. Meats Jan. 1978 7 p ref
(TDB-290) Avail: NTIS HC A02/MF A01

A triggered sphere gap in SF6 was developed to provide protection against switching overvoltages in metalclad substations. The trigger is activated when the voltage across the gap reaches a predetermined level, irrespective of its waveshape or polarity. Complete breakdown of the gap follows in 3 microsec due to delays in the triggering circuit, but there are prospects of reducing this. Protection against lightning surges at the basic insulation level is ensured by self-breakdown on the front of the wave. The protective level of the gap is well defined, the difference between the guaranteed withstand and flashover voltages being less than 2%. Since the gap must be replaced after each flashover, it should be used only where the probability of it operating is low. In those situations it could be considered as a small, low-cost alternative to a surge arrester. Author (ESA)

N78-28361# AEG-Telefunken, Backnang (West Germany).
SATELLITE HIGH POWER OUTPUT CIRCUITRY Final Report
W. Ullmann and D. J. Cracknell Paris ESA Jun. 1976 205 p refs Prepared jointly with Marconi Space and Defence Systems Ltd., Stanmore, Engl.
(Contract ESTEC-2350/74-PP)
(ESA-CR(P)-1018) Avail: NTIS HC A10/MF A01

The design and development of a satellite high power output circuitry (SHIPOC), including electrical, mechanical, and thermal aspects of waveguide components, harmonic filters, and bandpass filters are presented. The design, development, and production of a mechanical waveguide switch are discussed. The fabrication of a breadboard model, the so-called measurement setup (MESUP) of the SHIPOC is dealt with. MESUP consists of a diplexer, a mechanical switch, and directional couplers. The maximum applicable power in the frequency range 11.7 to 12.5 GHz is 600 W or 2 X 300 W. Low, medium, and high power measurements of the MESUP under normal air pressure and in high vacuum are presented. ESA

N78-28362# Plessey Co. Ltd., Towcester (England). Allen Clark Research Centre.
GaAs FET DRIVER AMPLIFIER Final Report
O. Neilsen and J. Arnold Paris ESA Nov. 1977 109 p refs (Contract ESTEC-2890/76-NL-AK(SC))
(CD.6500632; ESA-CR(P)-1041) Avail: NTIS HC A06/MF A01

A breadboard amplifier covering the band 11.5 to 12.6 GHz meeting a stringent performance specification which would be suitable as a driver stage within a single conversion transponder (for television broadcast satellites) was developed. The design concepts, amplifier realization, and performance results achieved for such an amplifier are outlined. Results indicate that the GaAs FET can be designed into amplifiers which are capable of meeting current and future requirements for space applications.
Author (ESA)

N78-28363# Universite des Sciences et Techniques de Lille (France). Centre Hyperfrequences et Semiconducteurs.
AVALANCHE FREQUENCY MULTIPLIER Final Report
E. Constant, P. A. Rolland, G. Salmer, and E. Playez Paris ESA Jan. 1978 75 p refs
(Contract ESTEC-2913/NL-AK(SC))
(ESA-CR(P)-1056) Avail: NTIS HC A04/MF A01

Results obtained from a 7000 hours reliability test performed on an X 16 avalanche frequency multiplier from about 960 MHz to 15,4 GHz are presented. The complete characteristics of the multiplier are described and especially their evolutions with time are pointed out. The computer aided design of two specified applications of such multipliers, is discussed: (1) an X 18 avalanche frequency multiplier from 1,5 to 27 GHz with 20 dbm output power, and (2) an X 12 avalanche frequency multiplier from 1,5 to 18 GHz with 20 dbm input power and maximum conversion efficiency. Author (ESA)

N78-28364# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
CONSTRUCTION OF A LOW NOISE MICROWAVE TRANSISTOR AMPLIFIER FOR THE ELRA RECEIVING CHANNEL [AUFBAU RAUSCHARMER MIKROWELLEN-TRANSISTORVERSTAERKER FUER DIE ELRA-EMPFANGSKANAELE]

K. Neumann Aug. 1977 36 p refs In GERMAN; ENGLISH summary
(FFM-260) Avail: NTIS HC A03/MF A01

The construction of a single-stage low noise 2.72 GHz microwave-preamplifier is described. The nose 2-port, gain, and stability of a microwave transistor are discussed on a theoretical basis. The performance results of the preamplifier in microstrip technique are 2.3 db noise figure, an associated gain of 11.8 db, and a +3.6 dbm power output at 1 db gain compression point. The transistor 35866 E Option 100 was used for the preamplifier and HXTR 6101 for the amplifier. Author (ESA)

N78-28365# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Electronics Main Dept.
APPLIED RESEARCH STUDY ON NOISE EFFECTS ON LOGICAL LEVEL DATA TRANSMISSION Final Report
W.-R. Ilenburg Paris ESA Jan. 1978 222 p refs
(Contract ESOC-2965/76-D-JS)
(ESA-CR(P)-1053) Avail: NTIS HC A10/MF A01

Effects influencing the success of data transmission of logic level in a noisy environment were investigated. There are limits of transmission that on one hand arise as a result of circuit internal constraints and on the other hand as a result of interference noise. To the first belong effects such as signal attenuation caused by the transmission line and line reflections, to the second disturbances due to ground noise, crosstalk, and radiated interference. Quantitative results on the influence of these different effects on data transmission are presented. Special attention was paid to susceptibility to ground noise. Several types of data transmission circuits, single-ended ones and balanced ones, with and without an isolation device, were analyzed. Seven classes of data transmission circuits were established. For each of these the limits of transmission expressed in terms of maximum line length, maximum data rate, and permissible interference noise were determined. Author (ESA)

N78-28366# Ticra A/S, Lyngby (Denmark).
STUDY OF FEED SYSTEMS FOR HIGH GAIN ANTENNAS Final Report
P. Balling and R. Jorgensen Paris ESA Jan. 1978 114 p refs
(Contract ESTEC-2892/76-NL-AK(SC))
(S-59-02; ESA-CR(P)-1054) Avail: NTIS HC A06/MF A01

The development of computer software for analysis of feed arrays for multiple beam or contoured beam antennas is described and data for possible elements of such arrays is presented. Two approaches for calculating the radiation from rotational symmetric feed elements protruding from a ground plane are presented. In one method a calculation is performed using an existing general-purpose method of moments program for a finite circular flange; the effects of the flange are removed by ray optical considerations. In the other method a system of integral equations is formulated to allow analysis of dielectrically loaded feed elements. Some problems remain in obtaining numerically stable solutions. Mutual impedance calculations were performed using the concept of minimum scattering antennas. Spherical mode expansions were utilized to allow accurate assessment of near field effects on the coupling. Author (ESA)

N78-28367# National Technical Information Service, Springfield, Va.
GUNN EFFECT AND TRANSFERRED ELECTRON DEVICES, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1977
William E. Reed Apr. 1978 261 p
(NTIS/PS-78/0360/4) Avail: NTIS HC $28.00/MF $28.00 CSCL 09A

An updated bibliography containing 256 abstracts concerning the application of Gunn effect and transferred electron devices to microwave generation, amplification, and control is presented. The Gunn effect in semiconductors is discussed. The design, fabrication, and properties of Gunn diodes and transferred electron devices are included. GRA

N78-28129*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STRUCTURAL DESIGN OF A 64-METER LOW-COST ANTENNA
M. S. Katow *In its* The Deep Space Network 15 Jun. 1978 p 258-275 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 09A

N78-28130*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CCM IMPLEMENTATION STATUS
R. A. Mancini *In its* The Deep Space Network 15 Jun. 1978 p 276-281 (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N78-28368 British Library Lending Div., Boston Spa (England).
DISPLACEMENT OF LIQUID BY RISING BUBBLES: COMMUNICATION 1
Yu. N. Orlov, V. P. Nemchenko, and S. I. Popel 1977 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), 1977, 1 p 13-15
(BLLD-M-25557-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

By numerical solutions on an electronic computer of differential equations of the motion of liquid near a bubble ascending under irrational regime the trajectories of particles and their overall vertical displacement were found. From this data it was calculated that the volume of liquid transferred upwards by a bubble is about half the bubble volume. G.Y.

N78-28369 Miami Univ., Coral Gables, Fla.
THREE DIMENSIONAL FREE SURFACE MODEL FOR THERMAL DISCHARGE STUDY Ph.D. Thesis
Ching-fen Tsai 1977 211 p
Avail: Univ. Microfilms Order No. 78-08254

The rapid growth both in electrical energy demand and in the unit size of thermal power plants has resulted in an increasing concern with the effects of heated water on the environment. The analysis of thermal discharges with the least possible environmental impact and with an increase in cooling efficiency has become an important part of power plant siting evaluation. The set of governing equations for mass, momentum, and energy were solved simultaneously by using the finite difference approximation method. Both surface and submerged types of discharge systems in an estuary and ocean coast were modelled with various environmental conditions. The results from the model were satisfactorily compared both with airborne I-R data and in-situ field measurements. When applying the model to a specific site, only the initial conditions, boundary conditions, and the bottom topography need to be modified. Dissert. Abstr.

N78-28370 Miami Univ., Coral Gables, Fla.
THERMAL CONTACT CONDUCTANCE OF STACKS Ph.D. Thesis
Parikshita Nayak 1977 251 p
Avail: Univ. Microfilms Order No. 78-08245

The thermal conductance of the contacts formed between laminated metals was experimentally investigated as a function of plate material, interstitial fluid, surface roughness, increasing contact pressure and decreasing contact pressure. The plate materials used were aluminum, yellow brass, stainless steel and magnetic core material. The interstitial fluids were air, vaseline, glycerine and transformer oil. The pressure range went up to 9000 psi. The results indicate that the thermal contact conductance increases with increase in the thermal conductivity of the contact materials, increases in the thermal conductivity of the interstitial fluid, decreases in surface roughness and decreases in meyer hardness of the contact materials. It was greater for the decreasing pressures than the increasing pressures.
Dissert. Abstr.

N78-28371 Minnesota Univ., Minneapolis.
HEAT TRANSFER DOWNSTREAM OF AN ASYMMETRIC

FLOW SEPARATION IN A CIRCULAR TUBE Ph.D. Thesis
Kwaku Koi Koram 1977 122 p
Avail: Univ. Microfilms Order No. 7809688

An experimental study on the effect of asymmetric flow separation and the subsequent reattachment and redevelopment on the heat transfer characteristics of a turbulent pipe flow was performed. The experiments were conducted in a pressurized closed loop system consisting of a pump, a long, unheated hydrodynamic development length, test section, heat exchanger, orifice flow meter and power supply. Heat transfer coefficients, both around the circumference and along the length of the test section, were determined for three nominal blockage ratios of 3/4, 1/2, and 1/4 respectively. Water was the working fluid and the Reynolds number ranged from 11,000 to about 60,000. The bulk of the data was obtained at Pr = 4. Supplementary runs at Pr = 8 enabled the effect of Prandtl number to be assessed. Dissert. Abstr.

N78-28372*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VELOCITY, TEMPERATURE, AND ELECTRICAL CONDUCTIVITY PROFILES IN HYDROGEN-OXYGEN MHD DUCT FLOWS
Mahesh S. Greywall and Carlson C. P. Pian 1978 11 p refs To be presented at the Winter Ann. Meeting of the ASME, San Francisco, 10-15 Dec. 1978 Prepared in cooperation with Wichita State Univ.
(Grant NsG-3186; Contract EF-77-A-01-2647)
(NASA-TM-78968; E-9717) Avail: NTIS HC A02/MF A01 CSCL 20D

Two-dimensional duct flow computations for radial distributions of velocity, temperature, and electrical conductivity are reported. Calculations were carried out for the flow conditions representative of a hydrogen-oxygen combustion driven MHD duct. Results are presented for: profiles of developing flow in a smooth duct, and for profiles of fully developed pipe flow with a specified streamwise shear stress distribution. The predicted temperature and electrical conductivity profiles for the developing flows compare well with available experimental data. G.G.

N78-28373*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC HEATING IN GAPS OF THERMAL PROTECTION SYSTEM TILE ARRAYS IN LAMINAR AND TURBULENT BOUNDARY LAYERS
Don E. Avery Jul. 1978 49 p refs
(NASA-TP-1187; L-12009) Avail: NTIS HC A03/MF A01 CSCL 20D

An experimental heat-transfer investigation was conducted on two staggered arrays of metallic tiles in laminar and turbulent boundary layers. This investigation was conducted for two purposes. The impingement heating distribution where flow in a longitudinal gap intersects a transverse gap and impinges on a downstream blocking tile was defined. The influence of tile and gap geometries was analyzed to develop empirical relationships for impingement heating in laminar and turbulent boundary layers. Tests were conducted in a high temperature structures tunnel at a nominal Mach number of 7, a nominal total temperature of 1800 K, and free-stream unit Reynolds numbers from 1.0 x 10 million to 4.8 x 10 million per meter. The test results were used to assess the impingement heating effects produced by parameters that include gap width, longitudinal gap length, slope of the tile forward-facing wall, boundary-layer displacement thickness, Reynolds number, and local surface pressure. G.G.

N78-28374*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TACT1, A COMPUTER PROGRAM FOR THE TRANSIENT THERMAL ANALYSIS OF A COOLED TURBINE BLADE OR VANE EQUIPPED WITH A COOLANT INSERT. 1. USERS MANUAL
Raymond E. Gaugler Aug. 1978 78 p refs
(NASA-TP-1271; E-9554) Avail: NTIS HC A05/MF A01 CSCL 21E

A computer program to calculate transient and steady state temperatures, pressures, and coolant flows in a cooled, axial flow turbine blade or vane with an impingement insert is described. Coolant side heat transfer coefficients are calculated internally in the program, with the user specifying either impingement or convection heat transfer at each internal flow station. Spent impingement air flows in a chordwise direction and is discharged through the trailing edge and through film cooling holes. The ability of the program to handle film cooling is limited by the internal flow model. Sample problems, with tables of input and output, are included in the report. Input to the program includes a description of the blade geometry, coolant supply conditions, outside thermal boundary conditions, and wheel speed. The blade wall can have two layers of different materials, such as a ceramic thermal barrier coating over a metallic substrate. Program output includes the temperature at each node, the coolant pressures and flow rates, and the inside heat-transfer coefficients. Author

N78-28375# Systems Science and Software, La Jolla, Calif.
ANALYSIS OF LASER SUPPORTED DETONATION WAVES AND LASER BEAM PROPAGATION IN TWO DIMENSIONS Final Report, 1 Oct. 1976 - 30 Sep. 1977
J. R. Triplett and M. H. Rice Feb. 1978 82 p refs
(Contract F49620-77-C-0006)
(AD-A053577; SSS-R-78-3564; AFOSR-78-0775TR) Avail: NTIS HC A14/MF A01 CSCL 21/2

It is shown that the Flux-Corrected Transport (FCT) algorithm correctly computes the propagation velocity and Chapman-Jouguet pressure for a laser-supported detonation (LSD) wave, even for zone size large compared to the radiation absorption length. A two-dimensional FCT computer program for analysis of LSD wave propagation phenomena is presented. A trajectory method for analysis of two-dimensional laser beam propagation in the paraxial Fresnel approximation, with continuously varying refractive index, is described. Author (GRA)

N78-28376# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.
SIMILARITY-LAW CHARACTERIZATION METHODS FOR ARBITRARY HYDRODYNAMIC ROUGHNESSES Final Report
Paul S. Granville Feb. 1978 38 p refs
(S041001)
(AD-A053563; Rept-78-SPD-815-01) Avail: NTIS HC A03/MF A01 CSCL 20/4

Methods are described for obtaining similarity-law characterization for arbitrary roughnesses indirectly from pipe-flow head loss, flat-plate drag, and rotating-disk torque. The roughness characterizations are used to make viscous drag predictions by means of boundary-layer calculations. A simplified drag prediction method using form factors and equivalent rough flat plates is described in detail. Author (GRA)

N78-28377# Naval Research Lab., Washington, D. C.
THE PARTIAL DONOR CELL METHOD Interim Report
K. Hain Feb. 1978 21 p refs
(RR0110941)
(AD-A053387; AD-E000136; NRL-MR-3713) Avail: NTIS HC A02/MF A01 CSCL 20/4

The partial donor cell method is a nonlinear combination of the donor cell method and a second order scheme. It prevents the appearance of maxima or minima caused by the higher order scheme. The dependent variable is stationary for zero velocity and the method can readily be generalized to multidimensions. Author (GRA)

N78-28378# Sandia Labs., Albuquerque, N. Mex.
SURVEY OF THE UTILITARIAN ASPECTS OF ADVANCED FLOW-FIELD DIAGNOSTIC TECHNIQUES
C. W. Peterson 1977 13 p refs Presented at AIAA Testing Conf., San Diego, Calif., 19 Apr. 1978
(Contract EY-76-C-04-0789)
(SAND-77-1784C; Conf-780419-1) Avail: NTIS HC A02/MF A01

Utilitarian information on the cost, development time, manpower, and data reduction requirements for advanced flow-field diagnostic techniques is an important input for deciding whether this new instrumentation should be applied to specific flow measurement problems. These and other practical aspects of laser velocimetry, Rayleigh and Raman scattering, electron beam fluorescence, holography, hot wire anemometry, fine wire

temperature probes, and rapid response pressure probes are summarized. The measurement capabilities of this instrumentation are also reviewed and basic references are listed. It is concluded that these new techniques provide new measurement capabilities and improved accuracy for many applications, but their complexity and cost should be recognized prior to their use in aerospace simulation facilities. ERA

N78-28379# Sandia Labs., Albuquerque, N. Mex.
HYDROMECHANICAL MODEL OF THE CRITICAL CONDITION OF HEAT TRANSFER IN BOILING LIQUIDS FOR THE CARE OF FREE CONVECTION
S. S. Kutateladze Jan. 1978 10 p refs Revised
(Contract EY-76-C-04-0789)
(SAND-78-6000; AEC-TR-1868-Rev) Avail: NTIS HC A02/MF A01

A hydromechanical theory of the critical conditions of heat transfer in boiling liquids (initiation of laminar boiling) is presented. A theoretical expression was obtained for the critical heat flux in the case of liquids with free convection, which is correct to within a constant factor. Calculated results using the hydromechanical theory of the initiation of laminar boiling compare satisfactorily with the results of experimental investigations of various liquids. The theory which is presented must be considered as a first approximation solution of the question. ERA

N78-28380# Sandia Corp., Livermore, Calif.
ISOTHERMAL TRANSFER OF A NEWTONIAN LIQUID VIA GAS PRESSURE
D. R. Chenoweth Jan. 1978 28 p
(Contract EY-76-C-04-0789)
(SAND-78-8202) Avail: NTIS HC A03/MF A01

The quasi-steady flow of Newtonian liquids in real plumbing systems between two finite reservoirs due to isothermal, perfect gas oven pressure was investigated. It was found that the nature of the parametric dependence of the total time of transfer is vastly different in turbulent and laminar flow, and when the dominance of the total head losses is by either pipe friction or pipe fittings. ERA

N78-28381# Kansas State Univ., Manhattan. Dept. of Mathematics.
SIMILARITY METHODS FOR REACTIVE FLOW Final Technical Report
J. D. Logan Aug. 1977 26 p refs
(Contract W-7405-eng-48)
(UCRL-13819; FTR-55) Avail: NTIS HC A03/MF A01

It was shown, using similarity or group theoretic methods, that the one dimensional, time dependent, Lagragian, equations of reactive flow can be reduced, via a similarity transformation, to a system of ordinary differential equations, from which a class of invariant solutions can be determined. ERA

N78-28382# California Univ., Livermore. Lawrence Livermore Lab.
SRS: A PROGRAM FOR COMPUTING AND MATCHING SHOCK RESPONSE SPECTRA
M. R. Posehn 10 Feb. 1978 32 p refs
(Contract W-7405-eng-48)
(UCID-17735) Avail: NTIS HC A03/MF A01

A program named SRS is available on the T-DAC computer, at B836, and at B854/858 for the calculation of shock response spectra of pulse waveforms used in environmental testing. The capabilities of the program are described and its use is illustrated by an example. ERA

N78-28383# Sandia Labs., Albuquerque, N. Mex.
HEAT TRANSFER BY CONDUCTION AND RADIATION
Lawrence F. Shampine 1978 13 p Presented at Mathematics Colloq., Mexico City, Mexico, 24 Jan. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0099C; Conf-780130-1) Avail: NTIS HC A02/MF A01

Equations are developed for the heat transfer by both conduction and radiation between two separated surfaces at different temperatures. ERA

N78-28384# Oak Ridge National Lab., Tenn. Energy Div.
COMPUTER SIMULATION OF STEADY-STATE PERFORMANCE OF AIR-TO-AIR HEAT PUMPS
R. D. Ellison and F. A. Creswick Mar. 1978 104 p refs
(Contract W-7405-eng-26)
(ORNL/CON-16) Avail: NTIS HC A06/MF A01

A computer model by which the performance of air-to-air heat pumps can be simulated is described. The model was used to evaluate analytically the improvements in performance that can be effected by various component improvements. The model is based on a trio of independent simulation programs. The three programs were combined so that user intervention and decision making between major steps of the simulation are necessary. The program was further modified by substituting a compressor model and adding a capillary tube model, both of which are described. Performance predicted by the computer model is shown to be in reasonable agreement with performance data observed. Planned modifications by which the utility of the computer model can be enhanced are described. User instructions and a FORTRAN listing of the program are included. ERA

N78-28385# Cornell Univ., Ithaca, N. Y. Sibley School of Mechanical and Aerospace Engineering.
AIR FLOW IN DRY NATURAL-DRAFT COOLING TOWERS SUBJECT TO WIND Final Report
F. K. Moore and K. E. Torrance 8 Dec. 1977 224 p refs
(Contract EY-76-S-02-2924)
(TID-28143) Avail: NTIS HC A10/MF A01

Wind and temperature inversions effects on the performance of dry, natural draft cooling towers were studied. Cooling tower aerodynamics, meteorology, cooling tower design, heat exchanger losses, etc., were investigated. The results showed that for dry, natural draft towers, the most significant wind-related losses for winds above about 5 m/s had to do with oblique entrance to the heat exchangers; for lower wind speeds, and for wet towers generally, tower exit and heat exchanger flow phenomena were equally important in causing losses; and inversion effects were due to a virtual fall of ITD, when warmer air was drawn from aloft. ERA

N78-28386# National Physical Lab., Teddington (England).
PRESSURE-VOLUME-TEMPERATURE PROPERTIES: METHOD OF CALCULATION OF RESULTS FROM MEASUREMENTS IN BEATTIE'S APPARATUS
D. Ambrose Nov. 1977 20 p refs
(NPL-Chem-75) Avail: NTIS HC A02/MF A01

Methods for calculating the results of fluid compressibility measurements using the Beattie apparatus are presented. Topics dealt with include terminology, input data, calibration of the volumenometer, the start set and the bench set, the blank run, calculation of volume, and calculation of pressure. An example of computation is given. ESA

N78-28387# Central Electricity Generating Board, London (England).
MEASUREMENT OF PULVERIZED FUEL FLOW TO BURNERS USING AN ACOUSTIC TECHNIQUE
R. F. Cook Apr. 1976 3 p
(TDB-259) Avail: NTIS HC A02/MF A01

An acoustic technique to measure the flow of pulverized fuel to burners in power stations is presented. A piezoelectric transducer is mounted on a metal plate located at a bend in the fuel pipe and detects the impact of the particles on the interior wall of the plate and/or excited vibration modes of the plate itself. The output from the transducer gives an indication of the rate of pulverized fuel flow through the pipe. Electronic filtering is used to remove the effect of spurious noise due to, for example, combustion noise, primary air flow and mill rumble. This apparatus has the advantage over other pulverized fuel flow measuring devices (e.g. sampling probes or annular venturi meters) in that it does not suffer appreciable wear from abrasion.
Author (ESA)

N78-28388# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
INVISCID FLUID MOTIONS INDUCED BY AN ELECTRIC CURRENT SOURCE. PART 1: PRELIMINARY ANALYSIS
A. J. M. Jansen Jun. 1977 68 p refs

(VTH-LR-228) Avail: NTIS HC A04/MF A01

The flow induced by an electric current source and its influence on the current density in an incompressible, inviscid medium were studied. The inviscid and viscous problems have no length or velocity scale and the solutions can be put in a similarity form. Detailed analytic study of the inviscid problem shows that the MHD equations, under the usual approximations, lead to solutions which have weak singularities at the axis of symmetry. The result is that in a neighborhood of the axis of symmetry of order of the Debye length the space charge density can not be neglected, so that in the equation of Euler the Coulomb force and the Lorentz force and in Ohm's law the convection current density and the current density become of equal order. This does not necessarily imply that this problem is not self-similar and that a different near and far field will occur. It might also be an explanation for the physically unrealistic phenomena which appear in the viscous problem. Author (ESA)

N78-28389# Delft Hydraulics Lab. (Netherlands).
INVESTIGATION INTO CAVITATION IN A PROTOTYPE PIPELINE CAUSED BY WATER HAMMER
G. A. Provoost Nov. 1976 20 p refs Presented at the 2d Intern. Conf. on Pressure Surges, London, 22-24 Sep. 1976
(Publ-170) Avail: NTIS HC A02/MF A01

In long pump discharge lines cavitation will occur as a consequence of pump failure. Column separation and two-phase flow will take place. Two mathematical models developed by the Delft University of Technology and the Delft Hydraulics Laboratory are reviewed briefly. The results of experiments in a horizontal circuit with high points are shown. A third model was developed in which the cavities were concentrated in grid points. This model showed good agreement with all laboratory tests. The technique used is described and verified by means of measurements in a prototype pipeline with a length of 27,900 m and an inside diameter of 1.80 m. At high points cavities developed to volumes of about 15 cu m and a duration of up to 80 sec was measured. The results of measurements and calculations to the prototype pipeline are shown, special attention being given to column separation at high points. Author (ESA)

N78-28390# Delft Hydraulics Lab. (Netherlands).
NON-UNIFORM STEADY FLOW - SHIFTS IN LIMITS OF STABILITY
H. J. Schoemaker Nov. 1976 34 p refs
(Publ-171) Avail: NTIS HC A03/MF A01

Publications on the stability of free surface flow, and possible instabilities, were analyzed, leading to some indication for hydraulic design. For purposes of design and a first interpretation of observed phenomena an analysis is presented in the form of simple calculations within the limits of validity of the usual approximations for gradually varied flow in prismatic channels of arbitrary cross sections and resistance laws. The effects of non-uniform velocity distribution were estimated. It appears that the non-uniformity of flow causes a considerable shift of the stability limit. Author (ESA)

N78-28391# Delft Hydraulics Lab. (Netherlands).
CAVITATION ON VALVES IN CORRELATION TO LIQUID PROPERTIES
D. M. Oldenziel and J. Teijema Dec. 1976 21 p refs Presented at the IAHR Symp. on Probl. of Hydraulic Machine - Hydraulic Struct. Interaction, Leningrad, 6-9 Sep. 1976
(Publ-173) Avail: NTIS HC A02/MF A01

To examine the cavitation behavior of hydraulic machines it is necessary to have: a good knowledge of the properties of the liquid used in prototype and in the test rig; a well defined method of detecting the occurrence of cavitation; and well defined cavitation criteria. A long-term theoretical and experimental research program has been started to obtain correlations between these three factors, as well as a deeper insight into scale laws and scale effects in model tests. The results of the correlations between the detection method and the liquid properties are dealt with. In particular, the detection of cavitation on valves is considered, while the facilities and instruments used are described briefly. Author (ESA)

N78-28392# Delft Hydraulics Lab. (Netherlands).
RECENT DEVELOPMENTS IN HYDRAULIC RESEARCH
J. J. Vinje Jul. 1977 40 p refs Presented at the UN Water Conf., Mar del Plata, Arg., 25 Mar. 1977
(Publ-183) Avail: NTIS HC A03/MF A01

An attempt is made to summarize some recent developments in hydraulic research, mainly last decade developments, against the background of research carried out in the Delft Hydraulics Laboratory. A number of examples are given illustrating developments in various fields of hydraulic engineering research, such as wave studies, harbour studies, navigation studies, coastal problems, tidal models, local scour and bottom protection, mathematical models for open channel flow and sewage systems, river models, locks situated between salt and fresh water areas, etc. ESA

N78-28393# Delft Hydraulics Lab. (Netherlands).
USE OF COMPUTERS FOR HYDRAULIC ENGINEERING PROBLEMS
C. B. Vreugdenhil Aug. 1977 19 p refs Presented at the Intern. Conf. on Computer Appl. in Develop. Countries, Bangkok, 22-25 Aug. 1977
(Publ-185) Avail: NTIS HC A02/MF A01

Some criteria to be applied when using mathematical models in hydraulics are discussed. It is argued that a good understanding of physical and numerical properties is needed because otherwise large errors may be present and go unnoticed. Also the purpose of application plays an important part in choosing the type of model. Examples are given, applied to the study of unsteady flow in open channels and rivers, to the mathematical description of time dependent bedload transport in alluvial rivers, and to the diffusion of some substance or heat in a river. Author (ESA)

N78-28394# Delft Hydraulics Lab. (Netherlands).
SELF-EXCITING GATE VIBRATIONS
P. A. Kolkman Oct. 1977 12 p Presented at the 17th Congr. of the Intern. Assoc. for Hydraulic Res., Baden-Baden, West Ger., 15-19 Aug. 1977
(Publ-186) Avail: NTIS HC A02/MF A01

The theory presented is valid for culvert valves and sluice gates. It describes the interaction of three elements: gate movement, forces due to flow around the gate, and fluid inertia upstream and downstream of the gate. The last of these is especially typical for gate vibrations. As an illustration of these elements a bathtub plug is introduced. An indication for unstable vibrations is the instantaneous hydrodynamic counterrigidity, which leads to the conclusion that for an underflow type of gate the suction force is the essential cause of self-excitation. Author (ESA)

N78-28395# National Technical Information Service, Springfield, Va.
HOLOGRAPHIC FLOW VISUALIZATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1978
Mona F. Smith Apr. 1978 79 p Supersedes NTIS/PS-77/0332, NTIS/PS-76/0338 and NTIS/PS-75/115
(NTIS/PS-78/0351/3; NTIS/PS-77/0332; NTIS/PS-76/0338; NTIS/PS-75/115) Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

A bibliography containing 74 abstracts concerning flow in wind tunnels, gas lasers, aircraft wakes, aircraft engines, supersonic flow, and shock waves is presented. Most of the techniques involve interferometric holography. GRA

N78-28396# National Technical Information Service, Springfield, Va.
HOLOGRAPHIC FLOW VISUALIZATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Apr. 1978
Mona F. Smith Apr. 1978 93 p Supersedes NTIS/PS-77/0333 and NTIS/PS-76/0339
(NTIS/PS-78/0352/1; NTIS/PS-77/0333; NTIS/PS-76/0339) Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

A bibliography containing 86 abstracts concerning worldwide research on holographic flow visualization is presented. Techniques theory, equipment, and various applications to measure flow in lasers, shock tubes, wind tunnels, and over aerodynamic surfaces were covered. GRA

N78-28397# Advisory Group for Aerospace Research and Development, Paris (France).
THREE DIMENSIONAL AND UNSTEADY SEPARATION AT HIGH REYNOLDS NUMBERS
Feb. 1978 244 p refs In ENGLISH and FRENCH Presented at Rhode-Saint-Genese, Belgium, 20-24 Feb. 1978 Amended version of N78-18375
(AGARD-LS-94; ISBN-92-835-0210-8) Avail: NTIS HC A11/MF A01

The present state of knowledge of three dimensional flows which contain regions of quasi-steady separation is reviewed including numerical methods for investigating such flows. The effect of three dimensional separating flows on the design and performance prediction of aircraft is emphasized. For individual titles, see N78-28398 through N78-28410.

N78-28398# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PRESENTATION OF THE SUBJECT
M. Sirieix *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds No. Feb. 1978 16 p refs (For primary document see N78-28397 19-34)
Avail: NTIS HC A11/MF A01

A brief overview of the lecture series is given. Flow visualization is used to describe three dimensional or unsteady separated flow. Various causes of separated flow are listed. The effects of separated flow on various aircraft configurations are discussed. J.M.S.

N78-28399# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
BOUNDARY SEPARATION PROBLEMS FACED BY AIRCRAFT DESIGNERS [LES PROBLEMES DE DECOLLEMENTS POSES A L'AVIONNEUR]
Pierre Perrier *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds No. Feb. 1978 11 p refs In FRENCH (For primary document see N78-28397 19-34)
Avail: NTIS HC A11/MF A01

Various forms of boundary separation problems in relation to quality flight performance and aircraft design were studied. Experimental methods to resolve these problems were analyzed in detail. Transl. by B.B.

N78-28400# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NUMERICAL SOLUTION OF VISCOUS-INVISCID INTERACTION PROBLEMS IN TWO-DIMENSIONAL COMPRESSIBLE FLOWS BASED ON THE NAVIER-STOKES EQUATIONS
Henri Viviand *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds No. Feb. 1978 21 p refs In FRENCH; ENGLISH summary (For primary document see N78-28397 19-34)
Avail: NTIS HC A11/MF A01

A review is presented of the approach based on the numerical solution of the Navier-Stokes number compressible flows. This global approach involves two distinct problems: on the one hand the numerical solution of the equations used, and on the other hand turbulence modeling to close the system of the averaged Navier-Stokes equations for the case of compressible separated flows. The validity of turbulence models is tested through comparisons between numerical prodictions anp experimental results. A general presentation of the problems and of the results which have been obtained is given. The essential features of the numerical methods and of the turbulence models which have been used are discussed. J.M.S.

N78-28401# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VISCID-INVISCID INTERACTION METHODS FOR TWO-DIMENSIONAL FLOWS, INCLUDING SEPARATION AND SHOCK WAVES
Jean-Claude LeBalleur *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds No. Feb. 1978 24 p refs In FRENCH; ENGLISH summary (For primary document see N78-28397 19-34)
Avail: NTIS HC A11/MF A01

Various methods which predict viscous flow when the Reynolds number is large enough for the inviscid approximation to be applied in the flow field are reviewed. Various approaches used to approximate the Navier-Stokes equations are outlined including: rational asymptotic methods both for weak and singular boundary layer interactions; truncated Navier-Stokes equations; numerical matching at large distance of boundary layer regions; viscid-inviscid patching in the vicinity of boundary layers according to the strong interaction of the interacting boundary layer concept; and simplified methods with empirical models of separation. Emphasis is placed on progress achieved with the interacting boundary layer methods. The degree of rationality, the inclusion of separated bubbles, the upstream influence in supersonic flows, and the progress achieved in making this approach a practical tool for various inviscid codes, subsonic, transonic, or supersonic are among the factors considered. J.M.S.

N78-28402*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PHENOMENOLOGICAL ASPECTS OF QUASI-STATIONARY CONTROLLED AND UNCONTROLLED THREE-DIMENSIONAL FLOW SEPARATIONS
David J. Peake *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds No. Feb. 1978 52 p refs (For primary document see N78-28397 19-34)
Avail: NTIS HC A11/MF A01 CSCL 20D

Quasi-steady three dimensional separated flows about bodies of large fineness ratio operating at large angles of incidence or yaw are discussed. The general character of the three dimensional attached boundary layer, the concept of limiting streamlines, and the physics of three dimensional separation and reattachment are among the factors considered. Specific examples are given. The advantages of swept, sharp edges that generate controlled (or fixed) three dimensional flow separations on a vehicle, due to the qualitatively unchanging flow field developed throughout the range of flight conditions, are emphasized. J.M.S.

N78-28403*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTRODUCTION TO UNSTEADY ASPECTS OF SEPARATION IN SUBSONIC AND TRANSONIC FLOW
W. J. McCroskey *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds No. Feb. 1978 8 p refs (For primary document see N78-28397 19-34)
Avail: NTIS HC A11/MF A01 CSCL 20D

Unsteady flow phenomena are reviewed with emphasis on separated flow in the subsonic and transonic regimes. Specific topics discussed include external flows past bluff bodies, unsteady separation on slender bodies, and internal flows. J.M.S.

N78-28404# Royal Aircraft Establishment, Bedford (England).
PREDICTION OF THE SEVERITY OF BUFFETING
D. G. Mabey *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds No. Feb. 1978 30 p refs (For primary document see N78-28397 19-34)
Avail: NTIS HC A11/MF A01

The influence of buffeting criteria on the choice of wing loading for fighter and transport aircraft is discussed. Wings are classified in terms of flow separations and buffeting. Wind tunnel model tests used to predict aircraft buffeting are described with emphasis on the importance of using wind tunnels with low levels of flow unsteadiness. Factors measured in the model tests include: unsteady wing-root strain in the first bending mode; unsteady pressure across the surface; and unsteady responses. Alternative methods of determining buffet onset are also considered. J.M.S.

N78-28405*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOME UNSTEADY SEPARATION PROBLEMS FOR SLENDER BODIES
W. J. McCroskey *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds No. Feb. 1978 11 p refs (For primary document see N78-28397 19-34)
Avail: NTIS HC A11/MF A01 CSCL 20D

The unsteady Kutta-Joukowski condition, dynamic stall on oscillating airfoils, and unsteady shock wave-boundary layer interaction are discussed. Emphasis is placed on developing reliable prediction techniques and suppression of unsteady separation

on oscillating control surfaces, wings, and rotating blades to improve aerodynamic stability. J.M.S.

N78-28406# Royal Aircraft Establishment, Farnborough (England). Dept. of Aerodynamics.
INVISCID FLUID MODEL, BASED ON ROLLED-UP VORTEX SHEETS, FOR THREE-DIMENSIONAL SEPARATION AT HIGH REYNOLDS NUMBER
J. H. B. Smith *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds No. Feb. 1978 27 p refs (For primary document see N78-28397 19-34)
Avail: NTIS HC A11/MF A01

The inviscid fluid models which are used to represent flows with three dimensional separation of vortex type are introduced and described. Their strengths and weaknesses are discussed and suggestions are made for improvements. A selection of results for a wide range of problems is presented. The difficulties which arise in trying to extend these models to represent separation from highly swept separation lines on smooth bodies are discussed and a view is given of the present position and developments in the immediate future. J.M.S.

N78-28407# Imperial Coll. of Science and Technology, London (England).
STRUCTURE OF TURBULENCE IN COMPLEX FLOWS
P. Bradshaw *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds No. Feb. 1978 7 p refs (For primary document see N78-28397 19-34)
Avail: NTIS HC A11/MF A01

The effects of unsteadiness or three dimensionality on turbulence and turbulence models are discussed. The response of shear layers to extra rates of strain is outlined and the concept of the 'fairly thin shear layer' presented. The special problems of separated flow are briefly reviewed. J.M.S.

N78-28408# Imperial Coll. of Science and Technology, London (England).
PREDICTION OF SEPARATION USING BOUNDARY LAYER THEORY
P. Bradshaw *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds No. Feb. 1978 8 p refs (For primary document see N78-28397 19-34)
Avail: NTIS HC A11/MF A01

The solution of equations for the shear layer with a pressure distribution at the shear layer edge derived from the inviscid solution is addressed. Presence of a singularity at separation, calculation methods for reversed flow, and cases where the thin shear layer approximation is not accurate enough are among the topics considered. J.M.S.

N78-28409*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PREDICTION OF UNSTEADY SEPARATED FLOWS ON OSCILLATING AIRFOILS
W. J. McCroskey *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds No. Feb. 1978 8 p refs (For primary document see N78-28397 19-34)
Avail: NTIS HC A11/MF A01 CSCL 20D

Techniques for calculating high Reynolds number flow around an airfoil undergoing dynamic stall are reviewed. Emphasis is placed on predicting the values of lift, drag, and pitching moments. Methods discussed include: the discrete potential vortex method; thin boundary layer method; strong interaction between inviscid and viscous flows; and solutions to the Navier-Stokes equations. Empirical methods for estimating unsteady airloads on oscillating airfoils are also described. These methods correlate force and moment data from wind tunnel tests to indicate the effects of various parameters, such as airfoil shape, Mach number, amplitude and frequency of sinosoidal oscillations, mean angle, and type of motion. J.M.S.

N78-28410*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STATUS AND FUTURE PROSPECTS OF USING NUMERICAL METHODS TO STUDY COMPLEX FLOWS AT HIGH REYNOLDS NUMBERS
Robert W. MacCormack *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds No. Feb. 1978 2 p
(For primary document see N78-28397 19-34)
Avail: NTIS HC A11/MF A01 CSCL 20D

The calculation of flow fields past aircraft configuration at flight Reynolds numbers is considered. Progress in devising accurate and efficient numerical methods, in understanding and modeling the physics of turbulence, and in developing reliable and powerful computer hardware is discussed. Emphasis is placed on efficient solutions to the Navier-Stokes equations. J.M.S.

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N78-28411* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
MICROCOMPUTERIZED ELECTRIC FIELD METER DIAGNOSTIC AND CALIBRATION SYSTEM Patent
Larry D. Holley and Jerry W. Mason, inventors (to NASA) (Federal Electric Corp., Paramus, N. J.) Issued 9 May 1978 6 p Filed 24 Mar. 1977 Supersedes N77-20343 (15 - 11, p 1444)
(NASA-Case-KSC-11035-1; US-Patent-4,088,951; US-Patent-Appl-SN-780874; US-Patent-Class-324-130; US-Patent-Class-324-32; US-Patent-Class-324-74) Avail: US Patent Office CSCL 14B

A computerized field meter calibration system which includes an apparatus for testing the calibration of field meters normally utilized for measuring electromagnetic field potentials is described. A reference voltage is applied to the field meter for causing signals to be produced on the output terminals thereof. A bank of relays is provided for selectively connecting output terminals of the field meter to a multiplexer by means of a digital voltmeter and an oscilloscope. A frequency-shift-keyed receiver is also connected to one of the terminals of the field meter for transmitting and converting a frequency shift keyed signal to a digital signal which is, subsequently, applied to the multiplexer.
Official Gazette of the U.S. Patent Office

N78-28412*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
TOTAL OZONE MEASUREMENT: INTERCOMPARISON OF PROTOTYPE NEW ZEALAND FILTER INSTRUMENT AND DOBSON SPECTROPHOTOMETER
Reid E. Basher Jul. 1978 17 p refs
(NASA-TP-1277) Avail: NTIS HC A02/MF A01 CSCL 14B

A five month intercomparison showed that the total ozone amounts of a prototype narrowband interference filter instrument were 7% less than those of a Dobson instrument for an ozone range of 0.300 to 0.500 atm cm and for airmasses less than two. The 7% bias was within the intercomparison calibration uncertainty. An airmass dependence in the Dobson instrument made the bias relationship airmass-dependent but the filter instrument's ozone values were generally constant to 2% up to an airmass of four. Long term drift in the bias was negligible.
G.G.

N78-28413# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A FIRST ORDER APPROXIMATION FOR THE DENSITY MATRIX OF A HEISENBERG FERROMAGNETIC OF ARBITRARY SPIN
A. Hengeltraub (Univ. Estad. de Campinas) and N. J. Parada May 1977 19 p refs Sponsored jointly by Fund. de Amparo a Pesquisa do Estad. de Sao Paulo, Fundo Nacl. de Desenvolvimento Cient. e Technol. and the Banco Nacl. de Desenvolviento Econ.
(INPE-1030-PE/056) Avail: NTIS HC A02/MF A01

A variational calculation based on first principles quantum statistical mechanics was performed, following a first order approximation in the density matrix for a Heisenberg ferromagnetic

system of identical spins S. It was shown that, for arbitrary spin S, 2S-1 special thermodynamical variables must be introduced and that they are completely determined by a variational calculation that minimizes the free energy of the system. It was also shown that the calculated reduced magnetization is the same as that obtained by the molecular field approximation. This gives a deeper insight into the meaning of the molecular field theory, as it corresponds to a first approximation for the density matrix of the Heisenberg ferromagnet, and is an essential step in the generalization of the constant coupling approximation for general spin values. B.B.

N78-28414*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CALIBRATION OF LONGWAVELENGTH EXOTECH MODEL 20-C SPECTRORADIOMETER
R. Kumar, B. Robinson (Purdue Univ.), and L. Silva (Purdue Univ.) Jun. 1978 30 p refs Submitted for publication
(Grant NGR-15-005-112)
(NASA-CR-156940; INPE-1296-PE/114) Avail: NTIS HC A03/MF A01 CSCL 14B

A brief description of the Exotech model 20-C field spectroradiometer which measures the spectral radiance of a target in the wavelength ranges 0.37 to 2.5 microns (short wavelength unit), 2.8 to 5.6 microns and 7.0 to 14 microns (long wavelength unit) is given. Wavelength calibration of long wavelength unit was done by knowing the strong, sharp and accurately known absorption bands of polystyrene, atmospheric carbon dioxide and methyl cyclohexane (liquid) in the infrared wavelength region. The spectral radiance calibration was done by recording spectral scans of the hot and the cold blackbodies and assuming that spectral radiance varies linearly with the signal. Author

N78-28415# ARO, Inc., Arnold Air Force Station, Tenn.
AEROBALLISTIC RANGE/TRACK PHOTOGRAPHIC INSTRUMENTATION DEVELOPMENT Final Report, 1 Jul. 1975 - 30 Sep. 1977
Paul H. Dugger AEDC Apr. 1978 35 p refs
(AD-A053591; AEDC-TR-98) Avail: NTIS HC A03/MF A01 CSCL 14/5

Development of photopyrometry systems employing state-of-the-art image intensifier devices has extended the lower limit for model surface temperature measurements in the AEDC Hyperballistic Range (G), for either free-flight or track-guided mode of operation, from 1,900 K to 1,250 K. Photographic resolvabilities (object plane) for free-flight and track versions of these photopyrometers are 300 micrometers (at best) and 150 micrometers, respectively. Track-compatible laser photography systems have been developed that provide object-plane resolvability of 25 micrometers as compared to 200 micrometers resolvability for similar systems used in free-flight work. Stereo-photography systems and an ultra-high-speed (10 to the 7th power frames per second) sequential laser photography system have been developed and applied in Track K.
Author (GRA)

N78-28416# Range Commanders Council, White Sands Missile Range, N. Mex. Inter-range Instrumentation Group.
IRIG STANDARD PARALLEL BINARY TIME CODE FORMATS Final Report
Apr. 1978 29 p Supersedes TCG-128-73
(AD-A053670; IRIG-STANDARD-128-77; TCG-128-73) Avail: NTIS HC A03/MF A01 CSCL 09/4

The need for time-of-year information with millisecond and microsecond resolution by data handling, processing and digital recording equipment makes the use of parallel binary time codes highly desirable. The intent of this document is to provide ground rules for maximum compatibility between present and future time generating equipment and the user interface. All timing equipment for new installations where parallel time is required shall follow this standard. For those test ranges and facilities where a large investment in parallel time generating equipment has already been made, the change over to the new parallel time code standards can be made over a period of years as equipment is replaced, or as new equipment is installed on an as-need basis. This standard should be adhered to even though use of the parallel binary time codes may be limited initially to the selection of one code or even particular portions of a code because of a lack of equipment to generate the complete code. Author (GRA)

N78-28417# Sandia Labs., Albuquerque, N. Mex.
DIAGNOSTICS-ORIENTED SYSTEM FOR THERMOCOUPLE THERMOMETRY
R. P. Reed 1978 14 p refs Presented at the 24th Intern. Instrumentation Symp., Albuquerque, N. Mex., 1 May 1978
(Contract EY-76-C-04-0789)
(SAND-77-1864C; Conf-780503-1) Avail: NTIS HC A02/MF A01

Thermocouple temperature measurements in hostile environments are subject to insidious error. The nature and source of some problems are described. Quick detection, diagnosis, and correction of faulty behavior is necessary to reduce error and to separate valid from spurious segments of data. Complementary diagnostic measures are required. They must be timely, convenient, and economical. Three techniques were developed to provide these: branched thermocouple circuits, COMUX Scanners (combinatorial line multiplexers), and a comprehensive computer-oriented data base. The principles of these novel measurement tools and an associated data acquisition system (DAS) which now uses them for research on in situ energy recovery methods are described. ERA

N78-28418# Sandia Labs., Albuquerque, N. Mex.
PORTABLE DATA ACQUISITION SYSTEM
R. P. Kromer 1977 30 p refs Presented at the Digital Signal Process. Symp., Albuquerque, N. Mex., 6 Dec. 1977
(Contract EY-76-C-04-0789)
(SAND-77-1874C; Conf-771206-10) Avail: NTIS HC A03/MF A01

The Air Force Base and Installation Security Systems (BISS) Program is founding a project to improve the performance of perimeter intrusion detection sensors by using state of the art signal processing techniques. The techniques being investigated require a signal frequency bandwidth that is considerably wider (up to 500 Hz) than that used in the present sensor electronics. For this reason, there was very little sensor data available when the project was started, and it was necessary to develop a special data library to be used in this signal processing development. A low noise data acquisition system specifically for use in the signal processing development project was developed. The requirements dictate that the system handle input signals down to a microvolt necessitating amplification of 110 to 120 db; and that the entire system be sufficiently portable to allow shipping as airline baggage. ERA

N78-28419# Stanford Linear Accelerator Center, Calif.
QUAD HAD MODULE
W. Pierce 1977 8 p
(Contract EY-76-S-03-0326)
(SLAC-TN-77-3) Avail: NTIS HC A02/MF A01

The function of the Quad Hazardous Atmosphere Detector (HAD) is to interface the General Monitor's Hazardous Atmosphere Detector (hydrocarbon gas detector) with the proposed LH2 Target Microprocessor control system. The module supplies heater current-330 mA regulated d.c.-to a sensor head which is located in or around the target. The module monitors the sensors and permits calibration of each sensor (SPAN adj.) and conditions the signal to present an output voltage of 0 to 10 volts corresponding to 0 to 100 percent of the Lower Explosive Limit (LEL). A diagram of the General Monitor Type No. 10022-1 is presented. The sensor contains two platinum elements. Both elements have the same temperature characteristics as the activated element, hence, the two elements track each other during ambient temperature changes. Presence of a combustible gas causes the treated element of the sensor to react with this gas, increasing the temperature of that element and unbalancing the bridge circuit. ERA

N78-28420# Stanford Linear Accelerator Center, Calif.
PORTABLE HAD
W. Pierce 1977 12 p
(Contract EY-76-S-03-0326)
(SLAC-TN-77-4) Avail: NTIS HC A02/MF A01

The control unit is designed to power the General Monitors hydrocarbon gas detector which is presently used by the LH2

Target group as their standard Hazardous Atmosphere Detector (HAD). The sensor requires a heater current of 330 mA (5 V) to establish the necessary temperature for the device to perform as specified. The sensor has two elements connected in series, one being coated with a proprietary catalyst that causes the gas to burn on the surface of the element, thus increasing the temperature; and since the element is a platinum compound, also increasing the element resistance. Circuit diagrams are presented and discussed. ERA

N78-28421# Brookhaven National Lab., Upton, N. Y.
APPLICATION OF COMPUTER-DRIVEN DISPLAYS TO SODAR SYSTEMS
John P. Scheib 1978 5 p refs Presented at the 4th Symp. on Meteorol. Observations and Instrumentation, Denver, 10-14 Apr. 1978
(Contract EY-76-C-02-0016)
(BNL-23631; Conf-780412-1) Avail: NTIS HC A02/MF A01

The small dynamic range of facsimile recorders and storage scopes was shown to limit useful observations of turbulent structure. Both special false color CRT techniques and gray scale overprinting yields a significant improvement in discerning the finer resolution of atmospheric structure. ERA

N78-28422# California Univ., Berkeley. Lawrence Berkeley Lab.
PRESSURIZED MULTIWIRE PROPORTIONAL CHAMBER FOR NEUTRON IMAGING
Bruce Director, Selig Kaplan, and Victor Perez-Mendez Oct. 1977 6 p refs Presented at the Nucl. Sci. Symp., San Francisco, 19 Oct. 1977
(Contract W-7405-eng-48)
(LBL-6779; Conf-771023-37) Avail: NTIS HC A02/MF A01

A pressurizable neutron sensitive multiwire proportional chamber was constructed to test the effect of increased gas density on image resolution. The chamber has dimensions of 25 cm x 25 cm and is pressurizable to 4 atm. With a single plate converter the thermal neutron detection efficiency was 6.3 percent for gadolinium and 2.3 percent for boron 10. For a four fold increase in chamber pressure the overall resolution improved more than a factor of two for boron, but relatively little for gadolinium. The effects of cathode biasing is also discussed. ERA

N78-28423# California Univ., Livermore. Lawrence Livermore Lab.
INTRODUCTION TO ALBEDO NEUTRON DOSIMETERS
D. E. Hankins 16 Jan. 1978 17 p refs Presented at 22d Ann. Meeting of the Health Phys. Soc., Atlanta, 3 Jul. 1977
(Contract W-7405-eng-48)
(UCRL-80581; Conf-770720-8) Avail: NTIS HC A02/MF A01

The design, operation, calibration, and performance of albedo neutron dosimeters are discussed. An albedo neutron dosimeter is designed to measure the flux of thermal neutrons which leave the body when a person is exposed to fast energy neutrons. The fast neutrons are scattered and moderated in the body, and many have lost most of their initial energy and emerge as thermal neutrons. The albedo neutron dosimeter is designed to detect this flux of thermal neutrons by using a thermal neutron detector. This could be any type of thermal neutron detector but in practical applications lithium fluoride (LiF) thermoluminescence dosimeters (TLDs) are most frequently used. Various types of albedo neutron dosimeters are described. Author (ERA)

N78-28424# Los Alamos Scientific Lab., N. Mex.
ELECTRONIC IDENTIFICATION Progress Report, 1 Jul. 1976 - 30 Sep. 1977
D. M. Holm, R. E. Bobbett, A. R. Koelle, J. A. Landt, and S. W. Depp Nov. 1977 6 p refs
(Contract W-7405-eng-36)
(LA-7020-PR) Avail: NTIS HC A02/MF A01

Passive, remote electronic identification and temperature monitoring of animals is now a proven concept which was demonstrated in a laboratory environment. Many of the necessary developments for eventual widespread use by the livestock industry are under way. A National Livestock Electronic Identification Board was formed to guide the future work and implementation of identification systems. At least one company indicated that they plan to produce commercial equipment. ERA

N78-28425# Oak Ridge National Lab., Tenn.
KFM: A HOMEMADE YET ACCURATE AND DEPENDABLE FALLOUT METER
C. H. Kearny, P. R. Barnes, C. V. Chester, and M. W. Cortner Jan. 1978 57 p refs
(Contract W-7405-eng-26)
(ORNL-5040) Avail: NTIS HC A04/MF A01

The KFM is a homemade fallout meter that can be made using only materials, tools, and skills found in millions of American homes. It is an accurate and dependable electroscope-capacitor. The KFM, in conjunction with its attached table and watch, is designed for use as a rate meter. Its attached table relates observed differences in the separation of its two leaves (before and after exposures at the listed time intervals) to the dose rates during exposures of these time intervals. In this manner dose rates from 30 mR/hr up to 43 R/hr can be determined with an accuracy of plus or minus 25%. A KFM can be charged with any one of the three expedient electrostatic charging devices described. Due to the use of anhydrite (made by heating gypsum from wallboard) inside a KFM and the expedient dry-bucket in which it can be charged when the air is very humid, this instrument always can be charged and used to obtain accurate measurements of gamma radiation no matter how high the relative humidity. ERA

N78-28426# Oak Ridge Y-12 Plant, Tenn.
PHASE-INSENSITIVE DETECTORS FOR AC RESISTANCE BRIDGES WITH APPLICATION TO TEMPERATURE CONTROLS SYSTEMS
M. G. Duncan 1978 10 p refs Presented at the 3d Region IEEE Conf. and Exhibit, Atlanta, 10 Apr. 1978
(Contract W-7405-eng-26)
(Y-DA-7468-S1; Conf-780404-2) Avail: NTIS HC A02/MF A01

The detection of ac resistance bridge error signals with low sensitivity to stray reactances is discussed. A detector, which compares magnitudes of two bridge signals, is discussed for use in a fast resistance temperature control to maintain constant resistance to better than 2 ppM at resistances down to 5 milliohms. ERA

N78-28427# Central Electricity Generating Board, London (England).
A LINEAR ELECTRONIC GAS FLOWMETER
R. A. Willgoss Nov. 1976 9 p
(TDB-269) Avail: NTIS HC A02/MF A01

Details are given of the design of a robust gas flowmeter giving a fast response (10 ms) electrical analog output linearly proportional to the flow rate in the range 0.005 to 0.25 1/s. The principle of the instrument is to detect the difference in pressure, across a constricting orifice in the gas line, using a strain gage. The need for such a transducer is primarily for use in on-line control of welding processes. Author (ESA)

N78-28428# Central Electricity Generating Board, London (England).
FIBRE-OPTICAL CURRENT MEASUREMENT
A. J. Rogers Mar. 1977 4 p
(TDB-280) Avail: NTIS HC A02/MF A01

A simple, cheap, and reliable arrangement for fiber optic current measurement, consisting of fiber, a light emitting diode, two polarizers, a photodetector, and an output signal amplifier, is described. Successful laboratory tests were carried out. The use of monomode fiber looks more promising than that of multimode fibers. ESA

N78-28429# Central Electricity Generating Board, London (England).
OXIDE THICKNESS MONITOR
A. Grindrod Apr. 1977 6 p
(TDB-281) Avail: NTIS HC A02/MF A01

A device to monitor the progression of oxide build-up on mild steel nuclear reactor structures is presented. The measuring probe consists of a single point, ferrite cored sensing coil, which is excited into oscillation by a simple transistorized oscillator.

The oscillator output frequency is fed by a buffer amplifier to a standard frequency meter. In-pile off-load use with remote manipulation can be applied. Author (ESA)

N78-28430# Central Electricity Generating Board, London (England).
DEVICES FOR THE DETERMINATION OF HEAT FLUX AND TUBE METAL TEMPERATURE IN HIGHLY RATED BOILERS
E. W. Northover May 1977 6 p
(TDB-283) Avail: NTIS HC A02/MF A01

Instruments are described that allow the local heat fluxes and tube metal temperatures to be continuously monitored in oil and coal fired boilers. The designs are such that the geometries and operating temperatures are similar to those of the evaporator tubes. The instruments will operate in heat fluxes up to 0.6 MW/sq m. Author (ESA)

N78-28431# Central Electricity Generating Board, London (England).
THE CERL FLUXPROBE - A PORTABLE, DIRECT READING, RADIANT HEAT FLUX MEASURING DEVICE
E. W. Northover Aug. 1977 6 p refs
(TDB-286) Avail: NTIS HC A02/MF A01

A portable self-contained, radiant heat-flux measuring device is described that enables measurements of local heat fluxes to be made through suitable apertures in a working boiler. In the instrument, the receiving surface of a thermally guarded measuring core is maintained at the temperature of the surrounding boiler tube surfaces by a natural convection heat sink, linked to the sensing head by a heat pipe. The design is such that the calibration is substantially independent of the amount of sensing head exposed to radiation. The received flux is presented in digital form. Author (ESA)

N78-28432# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
FUNCTIONAL CHARACTERISTICS OF A Ge BOLOMETER FOR THE DETECTION OF INFRARED RADIATION [CARATTERISTICHE FUNZIONALI DI UN BOLOMETRO AL Ge PER LA RIVELAZIONE DELLA RADIAZIONE INFRAROSSA]
A. DErcole and D. Lorenzetti Jul. 1977 28 p refs In ITALIAN
(LPS-77-19) Avail: NTIS HC A03/MF A01

The theory of bolometers is summarized and the technical and operational characteristics of the germanium bolometer is described. It is shown how the optimization of the signal to noise ratio depends on the increase of the responsivity L. ESA

N78-28433# British Aerospace Dynamics Group, Bristol (England). Electronics and Space Systems.
STUDY OF STRAPDOWN INERTIAL-OPTICAL ATTITUDE MEASUREMENT SYSTEMS Final Report
D. Todman and V. Wood Paris ESA Jan. 1978 428 p refs
(Contract ESTEC-2453/75-AK)
(ESS/SS-858; ESA-CR(P)-1051) Avail: NTIS HC A19/MF A01

The application of gyroscopes and star trackers to the problem of satellite attitude measurement was studied. The sensor outputs are processed in a small onboard microprocessor. Methods of extracting rate from incremental angle information were described. Also, predicting the drift angle in the quaternions at the end of a large angle slew maneuver due to sensor and processing errors was investigated. The results of the study of drift angle errors has enabled guidelines to be formulated for choosing an algorithm to meet a given mission accuracy. The use of adaptive filtering techniques for processing the gyro and star tracker outputs during a small angle tracking mode was considered. A common algorithm for processing the gyro outputs during both the large angle slew maneuver and the small angle tracking mode, was derived. Author (ESA)

N78-28434# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
MODERN MEASUREMENT PRINCIPLES [MODERNE MESSPRINZIPIEN]
F. Mettin 30 Dec. 1977 41 p refs In GERMAN
(DLR-IB-552-77/37) Avail: NTIS HC A03/MF A01

Recent measurement techniques involving piezoelectric sensors, piezoresistive sensors, sensors using the servo principle, incremental sensors, coded sensors, gyroscopic technique, strain gages, radar, optical sensors, and lasers were evaluated. An example of the use of strain gages in a manipulator system is given. ESA

36 LASERS AND MASERS

Includes parametric amplifiers.

N78-28435 Cornell Univ., Ithaca, N. Y.
ON OBTAINING INCREASED PEAK POWER FROM TUNABLE MODELOCKED DYE LASERS Ph.D. Thesis
John Judson Turner 1977 165 p
Avail: Univ. Microfilms Order No. 7807769

The operation of the cw modelocked dye laser is discussed, and various methods for detecting the short pulse output are described. The operation of the injection modelocked flashlamp pumped dye laser is outlined. Injection modelocking allows an increase in the peak power available from this flashlamp pumped dye laser from 5 kW to 1.5 MW. The design and operation of the modelocked cavity dumped dye laser is explained. An increase in peak power from the 150 watts of the cw modelocked dye laser to 2.5 kW is obtained, and this output is available at repetition rates of 500 KHz. The use of these high powers in the generation of tunable ultraviolet radiation is described. With the injection modelocked flashlamp pumped dye laser the total ultraviolet energy is 200 times more than that obtained without injection locking. With the cavity dumped laser there is an increase in the average ultraviolet power by 50% from the non-cavity dumped case. Dissert. Abstr.

N78-28436*# Hawaii Inst. of Geophysics, Honolulu.
HIGH-PRECISION LASER DISTANCE MEASUREMENT IN SUPPORT OF LUNAR LASER RANGING AT HALEAKALA, MAUI, 1976-1977
E. Berg, J. A. Carter, D. Harris, S. H. Laurila, B. E. Schenck, G. H. Sutton, J. E. Wolfe, and S. E. Cushman (Inst. for Astronomy, Honolulu) Jun. 1978 190 p refs
(Grant NsG-7179)
(NASA-CR-157312; HIG-78-5) Avail: NTIS HC A09/MF A01 CSCL 20E

The Hawaii Institute of Geophysics has implemented a comprehensive geodetic-geophysical support program to monitor local and regional crustal deformation on the island of Maui. Presented are the actual laser-measured line lengths and new coordinate computations of the line terminals, and the internal consistency of the measured line lengths is discussed. Several spacial chord lengths have been reduced to a Mercator plane, and conditioned adjustments on that plane have been made. G.G.

N78-28437*# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
OPTICAL AND INFRARED LASERS Final Report, 1 Dec. 1972 - 31 Mar. 1978
Ali Javan 1 Aug. 1978 440 p refs
(Grant NGL-22-009-741)
(NASA-CR-157325) Avail: NTIS HC A19/MF A01 CSCL 20E

Quantum mechanical predictions for the gain of an optically pumped CW FIR laser are presented for cases in which one or both of the pump and FIR transitions are pressure or Doppler broadened. The results are compared to those based on the rate equation model. Some of the quantum mechanical predictions are verified in CH3OH. Author

N78-28438# Avco-Everett Research Lab., Everett, Mass.
INVESTIGATION OF ELECTRON IMPACT PROCESSES RELEVANT TO VISIBLE LASERS Final Technical Report, 15 Aug. 1974 - 14 Nov. 1977
M. John, W. Boness, and H. A. Hyman 14 Nov. 1977 78 p refs
(Contract N00014-75-C-0064; DARPA Order 1806)
(AD-A053535) Avail: NTIS HC A05/MF A01 CSCL 20/8

This report describes the results of a combined experimental and theoretical program to determine the electron impact excitation cross sections of metastable argon and krypton atoms to higher lying states. This research has particular significance with regard to rare gas excimer laser research. During the course of the experimental program a crossed beams apparatus was constructed which employed a glow discharge source of metastable rare gas atoms. Initially the technique of electron spectroscopy was employed as the diagnostic, however, this was later replaced by fluorescence spectroscopy. Signal-to-noise problems restricted the scope of the measurements, however measurements were made for certain transitions of the type e + Kr 5 sj yields e + Kr 5 pj ' and e + Ar 4sj yields e + Ar 4 pj'. Measurements were also made for ground state excitation cross sections corresponding to line excitation of Kr 5p yields 5s and Ar 4p yields 4s transitions. GRA

N78-28439# Defence Research Establishment Valcartier (Quebec).

GAIN MEASUREMENTS ON THE SEQUENCE BANDS IN A TEA-COZ AMPLIFIER

P. Lavigne, J.-L. Lachambre, and G. Otis Apr. 1978 21 p refs

(AD-A054669; DREV-R-4102/78) Avail: NTIS HC A02/MF A01 CSCL 20/5

After having measured small-signal gains as high as 1.5% cm-1 in a TEA CO2 amplifier on the 00 2-(10 1, 02 1) sequence bands, we have concluded that the ratio of the gain coefficient of the sequence bands over that of the regular bands was independent of either the CO2 or He proportion in the gas mixture. This ratio rather increases with the electrical energy dumped into the active medium to reach a value of 1/3 at an excitation density of 140 J/lambda. Due to the relatively high gain of the sequence bands, it should be possible to have standard TEA CO2 lasers emit at frequencies where the atmospheric transmission at sea level is higher than at the regular emission frequencies. Furthermore, gain on the sequence bands was responsible for the anomalously high-gain coefficient measured at low J values of the R branch of the regular 9.4 micron transition in TEA amplifiers. Author (GRA)

N78-28440# RCA Labs., Princeton, N. J.

THE III-V HETEROJUNCTION STRUCTURES FOR LONG-WAVELENGTH INJECTION LASER Quarterly Interim Report, 16 Aug. 1977 - 15 Nov. 1977

C. J. Nuese, G. H. Olsen, R. E. Enstrom, and M. Ettenberg May 1978 12 p

(Contract DAAB07-76-C-0872; ARPA ORDER 3137)

(AD-A054670; PRRL-78-CR-27; ECOM-76-0872-5; QR-5) Avail: NTIS HC A02/MF A01 CSCL 20/5

Several double heterostructure injection lasers were fabricated from vapor-grown InGaAs P/InP. Laser wavelength was 1.4 micrometer. The lowest threshold current density observed was 2385 A/sq cm. The etching characteristics of bromine-methanol-phosphoric acid solutions on InP were tabulated. Author (GRA)

N78-28441# RCA Labs., Princeton, N. J.

THE III-V HETEROJUNCTION STRUCTURES FOR LONG-WAVELENGTH INJECTION LASER Quarterly Report, 16 Nov. 1977 - 15 Feb. 1978

C. J. Nuese, G. H. Olsen, R. E. Enstrom, and M. Ettenberg May 1978 11 p refs

(Contract DAAB07-76-C-0872; ARPA Order 3137)

(AD-A054671; ECOM-76-0872-6; QR-6) Avail: NTIS HC A02/MF A01 CSCL 20/5

CW operation of 1.4 micrometer injection lasers is reported. At 0 C threshold current was 225 mA. A computer-derived table of wavelength vs alloy composition of In GaAsP is presented. Author (GRA)

N78-28442# Letterman Army Inst. of Research, San Francisco, Calif. Div. of Non-ionizing Radiation.

MULTILINE LASER PROTECTION: THE COPPER VAPOR LASER Interim Report, 1 Dec. 1976 - 31 Jan. 1977

Harry Zwich, Bruce E. Stuck, and David L. Jenkins May 1977 21 p refs

(DA Proj. 3A7-62772-A-813)

(AD-A054123; LAIR-39) Avail: NTIS HC A02/MF A01 CSCL 20/5

The problem of optimizing protection and visibility for a multiline laser, the copper vapor laser (510 and 578 nm), is considered. The effects of three available laser protective materials on the sensitivity of the CIE photopic observer are graphically shown individually and in various combinations. The graphic representation of the effects on the human visibility curves is used rather than the single value, the luminous transmission. Didymium glass plus an argon laser protective material may provide the best protection but has the serious limitation of restriction of sensitivity in the 'blue-green' region of sensitivity in the blue-green region of the spectrum. Development of new laser protective systems as well as new materials for optimizing both protection and visibility are strongly recommended. Author (GRA)

N78-28443# California Univ., Livermore. Lawrence Livermore Lab.

DETECTION AND MEASUREMENT OF POST-ROSENBLUTH CONVECTIVE INSTABILITY IN MFTF WITH A HYBRID CO2 LASER-HETERODYNE DIAGNOSTIC SYSTEM

A. L. Peratt 5 Oct. 1977 19 p refs

(Contract W-7405-eng-48)

(UCRL-52339) Avail: NTIS HC A02/MF A01

To measure and classify the Post-Rosenbluth convective losscone instability in MFTF, a CO2 laser consisting of a TEA-pulsed section and a low pressure CW section, together with a light mixing receiver was used. Calculations show that the system offers sufficient power and sensitivity to detect instability throughout the range from strong coherent light scattering to weak incoherent scattering when the instability is eliminated. ERA

N78-28444# California Univ., Livermore. Lawrence Livermore Lab.

LASER-EXCITED FLUORESCENCE SPECTROSCOPY OF OXIDE GLASSES

M. J. Weber 1977 10 p refs Presented at the 7th Intern. Conf. on Amorphous and Liquid Semiconductors, Edinburgh, 27 Jun. - 1 Jul. 1977

(Contract W-7405-eng-48)

(UCRL-79499; Conf-7706112-1) Avail: NTIS HC A02/MF A01

Laser induced fluroescence line narrowing was applied to investigate the local fields and interactions of paramagnetic ions in oxide glasses. Studies included the site dependence of energy levels, radiative and nonradiative transition probabilities, homogeneous line broadening, and ion-ion energy transfer of rare earth ions. These results and the experimental techniques are reviewed briefly; the use of paramagnetic ions other than the rare earths is also considered. Recently, laser excited fluorescence spectroscopy was used to investigate modifications in the local structure of lithium borate glass caused by compositional changes and phase separation, and the site dependence of nonradiative relaxation of paramagnetic ions by multiphonon processes. These results and their implications are discussed. ERA

N78-28445# Sandia Labs., Albuquerque, N. Mex.

PULSED LASER WELDING OF MOLYBDENUM

J. L. Jellison 1977 3 p Presented at the 59th AWS Ann. Meeting, New Orleans, 3 Apr. 1978

(Contract EY-76-C-04-0789)

(SAND-77-1259; Conf-780406-1) Avail: NTIS HC A02/MF A01

The feasibility of welding thin-walled high vacuum devices was evaluated with the goal of defining a process capable of consistently producing welds which were leak tight and which possessed sufficient fracture toughness so as not to develop leaks later in life. The principal problem in welding molybdenum was related to a high propensity for intergranular fusion zone cracking due to grain boundary oxide films. The oxygen content of commercially available grades of molybdenum was sufficient to embrittle grain boundaries of typical coarse-grained fusion zones. The overall experimental program involved three approaches to improving the ductility of the molybdenum welds: (1) grain refinement, (2) reduction of the oxygen content of the fusion zone, and (3) redistribution of oxides. ERA

N78-28446# California Univ., Livermore. Lawrence Livermore Lab.
MATERIALS TESTING USING LASER ENERGY DEPOSITION
W. W. Wilcox and C. A. Calder 20 Dec. 1977 11 p refs Presented at the 24th Intern. Instrumentation Symp., Albuquerque, New Mex., 1-4 May 1978
(Contract W-7405-eng-48)
(UCRL-80469; Conf-780503-2) Avail: NTIS HC A02/MF A01

A convenient method for determining the elastic constants of materials was devised using the energy from a Q-switched neodymium-glass laser. Stress waves were induced in materials having circular rod or rectangular bar geometries by the absorption of energy from the laser. The wave transit times through the material were recorded with a piezoelectric transducer. Both dilation and shear wave velocities were determined in a single test using an ultrasonic technique and these velocities were used to calculate the elastic constants of the material. A comparison of the constants determined for ten common engineering materials using this method was made with constants derived using the conventional ultrasonic pulse technique and agreement was shown to be about one percent in most cases. Effects of material geometry are discussed, and surface damage to the material caused by laser energy absorption is shown. ERA

N78-28447# Hughes Aircraft Co., Culver City, Calif.
HF/DF LASER PUMPING TECHNIQUES Final Report, Mar. 1977 - Sep. 1977
John Wang, Injeyan Hagop, and F. N. Mastrup Sep. 1977 56 p refs
(Contract EY-77-C-04-3944)
(TID-28280) Avail: NTIS HC A04/MF A01

The feasibility of using a CW HF/DF laser as a high repetition rate optical pumping sourve for a 16 micrometers DF/DCN transfer laser was studied. If successful such a system has potential applications to the Laser Isotope Separation Program. ERA

N78-28448# Los Alamos Scientific Lab., N. Mex.
INTERFEROGRAM REDUCTION AND INTERPRETATION AS APPLIED TO THE OPTICAL ANALYSIS OF THE 10 kJ LASL LASER FUSION SYSTEM
V. K. Viswanathan, W. S. Hall, I. Liberman (Westinghouse Research Labs.), and G. Lawrence (Arizona Univ., Tucson) 1978 16 p refs Presented at the Mini-symp. on Reduction and Interpretation of Interferograms, Ft. Lauderdale, Fla., 11-12 Jan. 1978 Sponsored by ASTM
(Contract W-7405-eng-36)
(LA-UR-77-2896; Conf-780118-1) Avail: NTIS HC A02/MF A01

A 10 kJ eight-beam CO2 laser fusion system, currently under construction, has approximately one hundred optical elements per beam. The nominal system is diffraction limited and degradations in performance are primarily caused by imperfect components as well as alignment errors. Consequently, analysis and predictions for the system are very much dependent on the proper description of the imperfect components. The approach taken at LASL was to characterize the components interferometrically. Interferograms of the various components were made at the 633 nm He-Ne wavelength. Detailed results of the analysis for one complete leg of the eight beam system is presented. ERA

N78-28449# California Univ., Livermore. Lawrence Livermore Lab.
MICRORADIOGRAPHIC MEASUREMENT OF LASER FUSION TARGETS
R. M. Singleton, C. D. Hendricks, and B. W. Weinstein Sep. 1977 6 p refs Presented at Topical Meeting on Inertial Confinement Fusion, San Diego, Calif., 7 Feb. 1978
(UCRL-80148; Conf-780202) Avail: NTIS HC A02/MF A01

A technique is described for making contact microradiographs of microsphere targets, and for obtaining the target characteristics by fitting the data with a parametric equation. ERA

N78-28450# Battelle Memorial Inst., Geneva (Switzerland).
MINIATURE TEA LASER EMITTING PICOSECOND PULSES [LASER TEA MINIATURE EMETTANT DES PULSES PICOSECONDES]
14 Jul. 1977 5 p In FRENCH
Avail: NTIS HC A02/MF A01

A new TEA laser with a volume 100 to 1,000 times smaller than that of a commercial laser with the same peak power was developed. Due to its reduced dimensions and short pulse time, a new range of applications is possible. The main characteristics of the new high pressure nitrogen UV laser are listed. Possible applications are mentioned: plasma diagnostics and analysis in thermonuclear research; space-time impulse holography; miniature Pockels cell; miniature telemeter; pumping source for a liquid laser; energy source for pulse spectral analysis; Auston switch and other optical electronic applications; and triggerable spark gaps. ESA

N78-28122*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VLBI/LASER INTERCOMPARISON PROJECT: SESSION 2
H. F. Fliegel *In its* The Deep Space Network 15 Jun. 1978 p 186-189 (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 20E

N78-28127*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF HYDROGEN MASER FREQUENCY DRIFT DUE TO POSSIBLE DRIFTS IN LOAD VSWR AND PHASE ANGLE OF REFLECTION COEFFICIENT
R. W. Beatty and T. Y. Otosh *In its* The Deep Space Network 15 Jun. 1978 p 245-252 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 20E

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N78-28451 British Library Lending Div., Boston Spa (England).
PREPARATION BY MEANS OF PLASMA AND FLAME CUTTING FOR WELDING A HIGH TENSILE STEEL
I. D. Henderson and K. Seifert 28 Nov. 1977 11 p refs Transl. into ENGLISH from Mitteilungn der BEFA, 27, 3, 1976 p 1-4
(BLL-RARDE-TR-15/77-(7291.7965)) Avail: British Library Lending Div., Boston Spa, Engl.

Preparation for welding by thermal separation is used particularly for thick plates of constructional steel, and this is considerably more economical than mechanical methods. For this reason, the properties of flame and plasma cut welded edges of 30 mm thick plates of a high tensil steel (StE 70) were investigated. Nondestructive and metallographic examination show that no cracks are present at and below the cut surface. The depth of the zone structurally affected by the heat is about twice as great after plasma cutting as after flame cutting. Greater hardening did occur on flame cutting since a decarbonized zone formed below the plasma cut surface. Hand grinding was used to remove oxide from the surfaces. This method proved sufficient for the flame cuttings but the plasma cut surface required considerably greater removal of material. G.Y.

N78-28452 British Library Lending Div., Boston Spa (England).
LEAKAGE FLOW IN TURBINES AS THE CAUSE OF LATERAL FORCES GIVING RISE TO VIBRATIONS
K. Urlichs Aug. 1977 26 p refs Transl. into ENGLISH from Ing. Arch. (West Germany), v. 45, 1976 p 193-208
(BLL-CE-Trans-7062-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Thermal turbomachine rotors were observed undergoing self-excited vibrations unrelated to speed. Transverse forces resulting from gap excitation and leakage flow with whirling in the case of an eccentrically located rotor were studied. Control spaces in the tip clearance were defined, and fundamental equations for stream tubes were obtained. Flow and pressure distribution were also considered, as well as parameter studies for leakage flow with twisting. J.A.M.

N78-28453 British Library Lending Div., Boston Spa (England).
DAMAGE TO TURBOGENERATORS
H. Kugler 9 Aug. 1977 34 p refs Transl. into ENGLISH from Der Maschinenschaden (West Germany), vol. 49, no. 6, 1976 p 221-225
(BLL-CE-Trans-7191-(9022.09)) Avail: NTIS Avail: British Library Lending Div., Boston Spa, Engl.

The findings of studies of damage over the last few years, especially damage in the region of rotor end bells and the end windings are examined. It appears that this damage is attributed, not to thermal expansion, but to creeping of the winding copper. In conclusion, significant cases of damage are discussed. G.Y.

N78-28454 Cornell Univ., Ithaca, N. Y.
AN EXPERIMENTAL STUDY OF RECIPROCATING INTERNAL COMBUSTION ENGINES OPERATED ON HYDROGEN Ph.D. Thesis
Howard Stokes Homan 1978 220 p
Avail: Univ. Microfilms Order No. 7809490

In order to determine the potential of direct cylinder injection for hydrogen-fueled engines, power output, thermal efficiency, and oxides of nitrogen emissions were measured for cooperative fuel research engines configurations having the standard Otto head, the standard Diesel head, and a Diesel head modified to simulate the combustion chamber of D399 series Caterpillar diesel engines. Reciprocating internal combustion engines can be operated on hydrogen using direct cylinder injection starting late in the compression stroke. This mode of operation provides control over the rate of combustion, offers a solution to fundamental engine problems such as knock, rough running due to high rates of pressure rise, and to high amplitude pressure waves in the cylinder. Dissert. Abstr.

N78-28455 Maryland Univ., College Park.
MATRIX REPRESENTATION AND PREDICTION OF THREE-DIMENSIONAL CUTTING FORCES, INCLUDING CHATTER Ph.D. Thesis
Clayton Dupree McKindra 1977 222 p
Avail: Univ. Microfilms Order No. 78-08184

A mathematical model was developed to predict three-dimensional steady-state cutting forces and represent them in matrix form. Cutting was assumed to be in a plane so that the two-dimensional cutting theory could be applied. The location of the plane is such that the forces in it give rise to components along all three orthogonal directions. Comparison of the results with published data, and with experimental results obtained during three-dimensional lathe turning show that the matrix model accurately predicts three-dimensional steady-state cutting forces during turning of a long slender workpiece. The onset of regenerative chatter, the frequencies at which the chatter occurs and the vibration amplitude of the workpiece in the vertical and horizontal directions in response to regenerative chatter were also predicted. Dissert. Abstr.

N78-28456*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NINE PERCENT NICKEL STEEL HEAVY FORGING WELD REPAIR STUDY
Clarence P. Young, Jr., A. Harper Gerringer, Troy G. Brooks, and Robert F. Berry, Jr. Jul. 1978 34 p refs
(NASA-TM-78738) Avail: NTIS HC A03/MF A01 CSCL 13H

The feasibility of making weld repairs on heavy section 9% nickel steel forgings such as those being manufactured for the National Transonic Facility fan disk and fan drive shaft components was evaluated. Results indicate that 9% nickel steel in heavy forgings has very good weldability characteristics for the particular weld rod and weld procedures used. A comparison of data for known similar work is included. A.R.H.

N78-28457*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF FILTRATION ON ROLLING-ELEMENT-BEARING LIFE IN CONTAMINATED LUBRICANT ENVIRONMENT
Stuart H. Loewenthal, Donald W. Moyer (Tribon Bearing Co., Cleveland), and John J. Sherlock (Tribon Bearing Co., Cleveland) Jul. 1978 34 p refs
(NASA-TP-1272; E-9418) Avail: NTIS HC A03/MF A01 CSCL 13I

Fatigue tests were conducted on groups of 65 millimeter-bore ball bearings under four levels of filtration with and without a contaminated MIL-L-23699 lubricant. The baseline series used noncontaminated oil with 49 micron absolute filtration. In the remaining tests contaminants of the composition found in aircraft engine filters were injected into the filter's supply line at a constant rate of 125 milligrams per bearing-hour. The test filters had absolute particle removal ratings of 3, 30, 49, and 105 microns (0.45, 10, 30, and 70 microns nominal), respectively. Bearings were tested at 15,000 rpm under 4580 newtons radial load. Bearing life and running tract condition generally improved with finer filtration. The 3 and 30 micron filter bearings in a contaminated lubricant had statistically equivalent lives, approaching those from the baseline tests. The experimental lives of 49 micron bearings were approximately half the baseline bearing's lives. Bearings tested with the 105 micron filter experienced wear failures. The degree of surface distress, weight loss, and probable failure mode were found to be dependent on filtration level, with finer filtration being clearly beneficial. Author

N78-28458*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELASTOHYDRODYNAMIC LUBRICATION OF ELLIPTICAL CONTACTS FOR MATERIALS OF LOW ELASTIC MODULUS. 2: STARVED CONJUNCTION
Bernard J. Hamrock and Duncan Dowson (Leeds Univ., England) Jul. 1978 26 p refs Proposed for presentation at the Joint Lubrication Conf., Minneapolis, 24-26 Oct. 1978; sponsored by the Am. Soc. of Lubrication Engr. and the Am. Soc. of Mech. Engr.
(NASA-TP-1273; E-9558) Avail: NTIS HC A03/MF A01 CSCL 11H

Lubricant starvation effects on minimum film thickness for low-elastic modulus materials are studied by moving the inlet boundary closer to the contact center. Contour plots of the pressure and film thickness in and around the contact were obtained for fully flooded and starved lubrication conditions. These contour plots show that the inlet pressure contours become less circular and that the film thickness decreases substantially as the severity of starvation increases. G.G.

N78-28459*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF COLD WELDING USING ION BEAM TECHNOLOGY Patent Application
Bernard L. Sater, inventor (to NASA) Filed 28 Jul. 1978 10 p
(NASA-Case-LEW-12982-1; US-Patent-Appl-SN-929084) Avail: NTIS HC A02/MF A01 CSCL 13H

A method is described for cold welding metals in a vacuum using ion beams to prepare the surfaces of metals to be joined. The figure is a schematic diagram of an ion beam apparatus for carrying out the method. An expellant gas is stored in a high pressure tank and delivered to the ion source assembly. The ion source produces a unidirectional beam of gas molecules with uniform energies which, in a vacuum environment, is directed onto each surface to be cleaned and effectively sputters away the contamination oxide layer to expose clean underlying metal. When the surfaces to be jointed are sufficiently clean, they are pressed together with pressure adequate to assure that their asperities are brought into intimate contact throughout the area to be joined. This process provides a solid state cold weld with metal-to-metal bonding without causing gross deformation due to plastic flow and thinning of the material at the joint. NASA

N78-28460*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REDUNDANT MOTOR DRIVE SYSTEM Patent Application
John A. Calvert, inventor (to NASA) Filed 4 Aug. 1978 15 p
(NASA-Case-MFS-23777-1; US-Patent-Appl-SN-931217) Avail: NTIS HC A02/MF A01 CSCL 13I

Two separate gear trains, each including a motor adapted to perform a driving function without backdriving the other are included in a redundant motor drive system. A base supports parallel pillars which in turn supports a shaft having a worm gear affixed. A bearing housing of sleeve-like configuration is concentrically related to the shaft and is supported by the shaft for free rotation. A first and second normally quiescent drive

train, alternatively activatable, is provided for imparting rotation to the bearing housing. Each of the gear trains includes a selectively energizable motor for driving a worm meshed ith worm gear. The motor of the first gear train is mounted on bearing housing, while the motor of the second gear train is mounted on the base. Each gear train is adapted to restrain the worm gear against rotation, as the worm of the other gear train advances with respect to the worm gear in order to rotate the bearing housing. NASA

N78-28461# Naval Civil Engineering Lab., Port Hueneme, Calif.
EXPLORATORY DEVELOPMENT OF STRUCTURES FOR TACTICAL CONTAINER-SHELTER SYSTEM TACOSS: UNITS 11 AND 12 Final Report, Sep. 1972 - Sep. 1977
Richard H. Seabold Dec. 1977 50 p
(AD-A053505; CEL-TR-861) Avail: NTIS HC A03/MF A01 CSCL 13/4

Structures for two types of container-shelters were developed for use as part of the Tactical Container-Shelter System (TACOSS). Both types are to serve as 8 x 8 x 20-ft (2.438 x 2.438 x 6.096 m) intermodal shipping containers and as portable shelters. TACOSS 11 has removable side panels and telescoping corner posts. Cargo handling can take place through the personnel door and through both sides with any number of side panels removed. In the extended configuration, the roof can be extended upward by means of the telescoping corner posts to obtain a 10 ft (3.048 m) clear ceiling height, and closure panels can be inserted to increase the wall height. In the complexed configuration, side panels are removed and units can be coupled together to form shelters of any length, depending on the number of units used. The units also can be extended and complexed simultaneously to form shelters about 20 ft (6.096 m) wide, with a 10 ft (3.048 m) clear ceiling height, and of any length in increments of 8 ft (2.438 m). TACOSS 12 has a detachable pallet base. In the pallet configuration, the entire upper structure is lifted away in one piece and stored elsewhere. The floor of the structure in this configuration serves as an 8 x 20 ft (2.438 x 6.096 m) pallet for ordinary cargo, for a large equipment base, or for a floor of a prefabricated building module. Cargo handling can take place from both sides and both ends. Both types were designed, analyzed, fabricated, and tested. Neither type fully qualified as a container due to lack of weatherproofness and qualification as shelters was not fully validated due to the cancellation of drop and rain tests, but both concepts were found to be feasible. GRA

N78-28462# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
MANUFACTURING PROCESS FOR THE PRODUCTION OF NEAR NET SUPERALLOY DISK SHAPES BY ISOTHERMAL FORGING Final Report, 19 May 1975 - 21 Mar. 1977
B. H. Walker and L. N. Fuss May 1977 94 p
(Contract F33615-75-C-5184)
(AD-A053614; PWA-FR-4801; AFML-TR-77-80) Avail: NTIS HC A05/MF A01 CSCL 21/5

The objectives of this manufacturing technology program are: (1) to reduce the cost of manufacturing IN-100 disks, seals, and spacers for the F100 engine by forging closer to finish shape thereby reducing input material and machining costs; (2) to establish a reproducible manufacturing process for the production of near net disk, seal, and spacer shapes by advanced isothermal forging techniques; (3) to demonstrate the developed process and fully laboratory qualify the forgings; (4) to extend established nondestructive inspection techniques as required to assure full inspection of near net disk, seal, and spacer shapes. GRA

N78-28463# Bendix Corp., Kansas City, Mo.
OPTIMIZATION OF LEAD FRAME BOND PARAMETERS FOR PRODUCTION OF RELIABLE THERMOCOMPRESSION BONDS
R. J. Blazek and W. A. Piper 1978 6 p refs Presented at the IEEE Proc. Electron. Components Conf., Anaheim Calif., 24 Apr. 1978
(Contract EY-76-C-04-0613)
(BDX-613-1969; Conf-780416-2) Avail: NTIS HC A02/MF A01

Hybrid microcircuits utilized thermocompression bonding for the attachment of external gold-plated copper leads which provide electrical contact to thin film metallized ceramic substrates. Achieving an optimum bond requires understanding of the relationship of bond schedule, bond tool configuration, lead properties, and substrate gold conditions. One hundred six substrates were prepared with bond strength and flexure resistance determined by testing 7,505 leads. Optimum bonds were obtained by using copper alloy leads plated with nickel and type A gold (alkaline, noncyanide, bright, ductile deposit), a lead thickness of 0.18 mm, and a straight rail (0.38 mm flat, 0.051 mm/0.076 mm radius) tool configuration. Leads plated with nickel and type A gold produced higher bond strengths and lower percentage bond delaminations than leads plated without nickel and with type B gold (high purity, acidic, dull deposit) regardless of bond schedule. ERA

N78-28464# Bendix Corp., Kansas City, Mo.
HMC SPRAY DEVELOPING, STRIPPING, AND ETCHING Final Report
P. L. Blessner Feb. 1978 15 p
(Contract EY-76-C-04-0613)
(BDX-613-1803) Avail: NTIS HC A02/MF A01

A small chamber spray processing system was designed for the developing and stripping of photoresist and the etching of thin films for hybrid microcircuits. A model chamber of dry-film photoresist on 95 by 114 mm ceramic substrates. Line width variations obtained with this chamber were within the tolerance required for production HMCs. ERA

N78-28465# Mechanical Technology, Inc., Latham, N. Y.
EIGHT-STAGE STEAM TURBINE ROTOR DYNAMICS ANALYSIS
G. Siegrist and A. E. Richey Nov. 1977 33 p
(Contract EY-76-C-02-2835)
(COO-2835-5; TR-78TR13) Avail: NTIS HC A03/MF A01

Reports of a design review and dynamic analysis of the rotor system of an 8 stage steam turbine for propulsion systems are presented. Analysis of the rotor system indicates the potential of a rotor dynamics problem in the first critical speed range. Good balance and an effective turbine end bearing damper are required to control the rotor dynamic response. The existing turbine end bearing damper is inadequate. Examination of the hardware revealed evidence of motion of the squirrel cage within the housing. Design modifications are required to achieve desired damping characteristics. Turbine wheel fits, measured after disassembly of the turbine exceeded limits specified by the design drawings and contribute to the potential rotor unbalance problem. Further, balance shifts may occur during operation due to the loose wheel fits. Author (ERA)

N78-28466*# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.
STUDY AND PROGRAM PLAN FOR IMPROVED HEAVY DUTY GAS TURBINE ENGINE CERAMIC COMPONENT DEVELOPMENT Final Report
H. E. Helms May 1977 156 p refs
(Contract EX-76-A-31-1011; NAS3-20064)
(NASA-CR-135230; CONS/0064-1; DDA-EDR-9068) Avail: NTIS HC A08/MF A01 CSCL 21A

A fuel economy of 213 mg/W. h(0.35 lb/hp-hr) brake specific fuel consumption by 1981 through use of ceramic materials, with conformance to current and projected Federal noise and emission standards was demonstrated and a commercially viable engine is described. Study results show that increased turbine inlet and regenerator inlet temperatures, through the use of ceramic materials, contribute the greatest amount to achieving fuel economy goals. Further, improved component efficiencies (for the compressor, gasifier turbine, power turbine, and regenerator disks show significant additional gains in fuel economy. Fuel saved in a 500,000 mile engine life, risk levels involved in development, and engine related life cycle costs for fleets (100 units) of trucks and buses were used as criteria to select work goals for the planned program. ERA

N78-28467# Sandia Labs., Albuquerque, N. Mex.
CRASH TESTING OF NUCLEAR FUEL SHIPPING CONTAINERS
R. M. Jefferson and H. R. Yoshimura Dec. 1977 50 p refs

(Contract EY-76-C-04-0789)
(SAND-77-1462) Avail: NTIS HC A03/MF A01

In an attempt to understand the dynamics of extra severe transportation accidents and to evaluate state-of-the-art computational techniques for predicting the dynamic response of shipping casks involved in vehicular system crashes, a program was initiated to investigate these areas. Computational methods for predicting the effects of the accident environment were utilized and the damage incurred by a container as the result of such an accident was calculated. The second phase involves the testing of 1/8 scale models of transportation systems. Through the use of instrumentation and high-speed motion photography, the accident environments and physical damage mechanisms were studied in detail. After correlating the results of these first two phases, a full scale event involving representative hardware was conducted. Results indicate that both computational techniques and scale modeling are viable engineering approaches to studying accident environments and physical damage to shipping casks. ERA

N78-28468# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.

ADVANCED INDUSTRIAL GAS TURBINE TECHNOLOGY READINESS DEMONSTRATION PROGRAM. PHASE 1: DESIGN STUDY Final Report

J. K. Schweitzer and B. T. Brown Oct. 1977 220 p
(Contract EY-76-C-05-5035)
(HCP/T5035-1) Avail: NTIS HC A10/MF A01

Design optimization studies and resulting conceptual engine definition of an advanced industrial gas turbine in the 15,000 shp/10Mw class are presented along with the detail aerodynamic and mechanical design of the 18:1 pressure ratio axial/centrifugal compressor and 2500 F combustor exit temperature (CET) turbine first vane and blade critical component test rigs. The design approach was to combine advanced aircraft turbine cooling and high pressure compressor technology with the requirements of simplicity and rugged construction for industrial engines to achieve increased efficiency, improved durability, fuel flexibility, fewer number of parts, and hence, lower initial and operating costs as compared to current industrial gas turbines. Cycle studies indicate that a specific fuel consumption at ISO conditions of 0.37 is attainable. ERA

N78-28469# Sandia Labs., Albuquerque, N. Mex.

ANALYSIS OF THE QUALIFICATION TEST STANDARDS FOR SMALL RADIOACTIVE MATERIAL SHIPPING PACKAGES

James D. McClure 1978 7 p refs Presented at the 5th Symp. on Packaging and Transportation of Radioact. Mater., Las Vegas, Nev., 7 May 1978
(Contract EY-76-C-04-0789)
(SAND-78-0125C; Conf-780506-5) Avail: NTIS HC A02/MF A01

The severity of the existing regulatory standards which are used to license radioactive material (RAM) shipping packages is compared with the severity of transportation accidents. It is indicated that the present regulatory standards provide significantly higher levels of protection for surface transportation modes (truck, rail) than for RAM packages shipped by aircraft. It is also determined that crush can occur in all of the transport modes and is not presently included in existing regulations for accident conditions. Test proposals are included for the surface transport mode (truck, rail) and the air transport mode. ERA

N78-28470# Sandia Labs., Albuquerque, N. Mex. Simulation Div.

DYNAMIC TESTS ON METALLIC IMPACT LIMITERS

Mathias J. Sagartz Jan. 1978 31 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1939) Avail: NTIS HC A03/MF A01

Different types of metallic impact limiters were tested; plain fins, laterally stiffened fins and tubes whose axes were aligned with the direction of impact. All specimens were made of 304 stainless steel and were annealed before testing. A heavy steel drop table of variable mass and moving at about 13.4 m/s (44 ft/s) was used to impact the specimens which were mounted on a stationary base. Impact velocity, drop table acceleration vs. time and force vs. time were measured on each test and were used to calculate the energy absorbed by the impact limiters. Results showed that the peak stress that a plain fin can transmit to the cask body can be several times the static stress of the fin. Also as buckling proceeds the load in a plain fin drops significantly and the rate at which it absorbs energy falls off dramatically, making the fin a rather inefficient energy absorber overall. The laterally stiffened fin and the cylinders did not exhibit rapid decrease in load carrying capacity with deformation and, hence, were able to absorb relatively more energy per unit volume of material. ERA

N78-28471# European Space Agency, Paris (France).

STUDY OF AN AIR LIFT PUMP IN A CENTRIFUGAL FORCE FIELD

Jochen Mante Apr. 1978 116 p refs Transl. into ENGLISH of 'Untersuch. eines Druckgasfluessigkeitshebers in einem Zentrifugalkraftfeld', DFVLR, Berlin Report DLR-FB-77-40, 12 Sep. 1977 Original report in GERMAN previously announced as N78-18436 Original German report available from DFVLR, Cologne DM 37,30
(ESA-TT-470; DLR-FB-77-40) Avail: NTIS HC A06/MF A01

The pumping characteristics of an air-lift pump and the two-phase flow occurring in the pipe line were studied for conditions in which the magnitude of the force field is up to 10 times gravitational acceleration. In the theoretical section, the mathematical fundamentals describing the pumping characteristics and the two-phase flow are stated; pipe flow losses are expressed principally as a function of the change in the momentum flow in the region where the two-phase flow is generated, and calculation of the velocities of the individual phases is based on an extension of presently known relationships. In the experimental section, the theoretical premises are checked and required functions and constants are determined empirically. For this purpose an air-lift pump was operated on a rotating platform with variable centrifugal acceleration and the pumping characteristics and resulting flow properties were measured. Results of these measurements confirm the validity of the assumptions and premises used. Author (ESA)

N78-28472# Central Electricity Generating Board, London (England).

IMPROVEMENTS IN KEYHOLE WELDING

J. C. Metcalfe and M. B. C. Quigley Apr. 1976 10 p
(TDB-261) Avail: NTIS HC A02/MF A01

A method of controlling the keyhole welding process is described. The light emission from the efflux plasma is monitored to detect the deviation of the plasma from a plane along the line of the weld containing the direction of the incident beam or plasma arc. Welding is stopped if the deviation exceeds a specific amount. The efflux plasma is monitored by means of photo-sensors mounted underneath the weld. Control means may be provided for initiating traverse between the workpiece and welding head, controlling the power output of the welding head, and controlling the speed of traverse. Author (ESA)

N78-28473# Central Electricity Generating Board, London (England).

SAMPLING VALVE FOR MEASURING FLUCTUATING CONCENTRATIONS OF HYDROCARBON GASES

J. E. Fackrell Mar. 1977 6 p
(TDB-277) Avail: NTIS HC A02/MF A01

A system which enables a flame ionization detector (FID) used at present for mean concentration measurements, to also be used for measuring instantaneous values of concentration is described. It consists of a small valve which is placed at the required mesuring point and which, at fixed time intervals, injects a sample of air into a continuous carrier line of nitrogen flowing to the FID. The flow rate and tube size of the carrier line are chosen, using a theory of G. I. Taylor (1953), so as to limit the longitudinal dispersion of the sample within the tubing. Each sample, therefore, arrives at the FID as a discrete pulse in concentration with a peak value (or area) proportional to its initial concentration. The measurement of a series of such pulses separated by sufficient nitrogen to prevent intermixing (about one second intervals) enables statistical information, such as probability distributions of concentration, to be obtained.
Author (ESA)

N78-28474# Research Inst. of National Defence, Stockholm (Sweden).
A THEORETICAL AND EXPERIMENTAL STUDY OF THE PENETRATION MECHANICS OF RIGID PROJECTILES
Aake Persson 1977 15 p refs
(FOA-B-20017-D4; ISBN-91-7056-049-8) Avail: NTIS HC A02/MF A01; Res. Inst. of Natl. Defence, Stockholm Sw.Kr. 5

At the First International Symposium on Ballistics, Orlando, Florida, 1974, research work was presented which was directed towards the establishment of a simple model for a rigid sphere impacting a relatively thick target. A continuation of that work is described. First, theoretical parametric studies are analyzed, demonstrating the influence on the penetration process of a variation of parameters such as impact velocity, edge-effect strength, penetrator density, and target-material properties. The penetration model is then extended from spherical to arbitrary nose shapes. The values of the parameters in the penetration model are determined from instrumented-pressure-bar experiments in which the penetration force is measured as a function of penetration depth. Some results are cited of experiments in which the thickness and diameter of the target and the shape of the projectile nose were varied. Finally, the penetration model is used to explain the bending of a tungsten rod obliquely penetrating an armor plate. Author (ESA)

N78-28475# National Centre of Tribology, Risley (England). European Space Tribology Lab.
THERMAL VACUUM LIFE TEST OF AN MSDS SOLAR ARRAY DRIVE (MSDS NO 2). FIRST 2 YEARS OF OPERATION
J. Gillies and R. W. Watters Paris ESA Dec. 1977 47 p
(Contract ESTEC-2584/75-MD)
(ESA-ESTL-30; ESA-CR(P)-1050) Avail: NTIS HC A03/MF A01

Results concerning the first two years of thermal vacuum testing of a solar array drive are reported. The shaft is rotated at its normal speed of one revolution a day. A radiator surrounding the mechanism in the vacuum chamber is held at a constant temperature of 22.5 C, while the shaft temperature, measured at the top of the shaft inboard of the large shaft bearing, is charged at six monthly intervals so that it operates at either 10 C or 60 C. At the beginning of each cycle, thirty eclipse temperature cycles are carried out in which the shaft temperature is reduced from 60 C to 0 C in 72 minutes and returned to 60 C. A 7 year test period is envisaged. The mechanism until now operated within specification limits. The signal slip rings show an increasing level of electrical noise. ESA

N78-28128*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LATERAL FORCES INDUCED BY A MISALIGNED ROLLER
H. McGinness *In its* The Deep Space Network 15 Jun. 1978 p 253-257 ref (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 20I

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N78-28476# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
PRESENT AND POSSIBLE FUTURE APPLICATIONS OF NEUTRON RADIOGRAPHY IN AVIATION IN THE NETHERLANDS
E. A. B. DeGraaf 30 Aug. 1976 21 p refs
(Contract RNLAF-RB-KLU-1976.C12)
(NLR-TR-76081-U) Avail: NTIS HC A02/MF A01

The principles and techniques of neutron radiography are reviewed and neutron sources are discussed. Facilities for neutron radiography in the Netherlands are described and examples of applications of neutron radiography, especially in the field of corrosion detection in aluminum and inspection of brazed joints, are given. Future research and possibilities are indicated. Author (ESA)

N78-28477# Central Electricity Generating Board, London (England).
A NEW METHOD FOR ULTRASONIC INSPECTION
P. D. Hanstead Feb. 1978 5 p
(TDB-291) Avail: NTIS HC A02/MF A01

Conventional ultrasonic inspection operates by sending a beam of ultrasound pulses into the medium being examined. Any defects, for example holes or cracks, produce echoes whose range can be measured accurately; however, because the ultrasonic beam cannot be made narrow, the position of a feature producing an echo cannot be measured with the desired accuracy. Although the range accuracy is sufficient, this is not enough in itself to specify a position within the medium. Author (ESA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N78-28478 British Library Lending Div., Boston Spa (England).
OPTIMIZATION OF SHEET STRUCTURES ILLUSTRATED WITH REFERENCE TO LONG CYLINDRICAL SHELLS
D. Hartmann Jan. 1978 15 p refs Transl. into ENGLISH from work document 4.8 (West Germany), 1976 15 p
(BLL-RTS-10968) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

An optimization routine was developed, whereby problems could be formulated in purely algorithmic form. The long cylindrical shell example was used to illustrate how to set up a mathematical-mechanical optimization model with decision variables, quality criteria, and constraints. J.A.M.

N78-28479 Stanford Univ., Calif.
ON MAXIMUM STRENGTH OF PLATES UNDER AXIAL COMPRESSION: EFFECTS OF CURVATURE AND EDGE-STIFFENER EXTENSIONAL AND TORSIONAL RIGIDITY Ph.D. Thesis
SiYoong Yoo 1978 154 p
Avail: Univ. Microfilms Order No. 7808870

The kinematics of von Karman-Donnel curved plate theory in a variational formulation based on Reissner's principle are used, suitably modified to accommodate a constitutive law representing the secant-modulus deformation theory of plasticity. It is shown that a 7075-T6 aluminum, closely stiffened panel designed for simultaneous local and general instability by the minimum-weight approach can be less efficient over the practical range of axial load intensities than its discretely stiffened counterpart that fails by crippling. A similar study based on 2024-T3 aluminum demonstrated that only in the range of light load intensities does the discretely stiffened panel outperform the smeared stiffener concept designed by minimum-weight procedures. However, for limit stress in the vicinity of proportional-limit stress, because of its lower yield stress, the 2024-T3 panel, unlike the 7075-T6 panel, cannot develop a maximum load 50 percent greater than the buckling or limit stress and thus must be eliminated from consideration. Dissert. Abstr.

N78-28480*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL STUDIES OF EFFECTS OF TILT AND STRUCTURAL ASYMMETRY ON VIBRATION CHARACTERISTICS OF THIN-WALL CIRCULAR CYLINDERS PARTLY FILLED WITH LIQUID
Robert W. Herr Jul. 1978 41 p ref
(NASA-TP-1211; L-12049) Avail: NTIS HC A03/MF A01 CSCL 20K

The effects of tilt and structural asymmetry on the vibration characteristics of partly liquid-filled thin-wall cylinders were experimentally studied. It was found that tilting the longitudinal

axis of a partly filled axisymmetric cylinder from the vertical could markedly reduce its resonant frequencies and change significantly the shape of the circumferential modes. For the minimum frequency modes, vibratory motion occurred only on that side of the cylinder where the liquid was deepest. An empirical equation was derived that gives the equivalent liquid depth of an untilted cylinder having the same minimum resonant frequency as a tilted, partly filled cylinder. Circumferential mode shapes of an untilted asymmetric cylinder were similar to those of the tilted, partly filled axisymmetric cylinder. Vibratory mition in the minimum frequency modes occurred in most instances only on the side of minimum thickness. Correlation between test data and results from a reformulated NASTRAN hydroelastic analysis was excellent. J.M.S.

N78-28481*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYSIS OF PREFLUTTER AND POSTFLUTTER CHARACTERISTICS WITH MOTION-MATCHED AERODYNAMIC FORCES
Herbert J. Cunningham Jul. 1978 33 p refs
(NASA-TP-1232; L-12109) Avail: NTIS HC A03/MF A01 CSCL 01C

The development of the equations of dynamic equilibrium for a lifting surface from Lagrange's equation is reviewed and restated for general exponential growing and decaying oscillatory motion. Aerodynamic forces for this motion are obtained from the three-dimensional supersonic kernel function that is newly generalized to complex reduced frequencies. Illustrative calculations were made for two flutter models at supersonic Mach numbers. Preflutter and postflutter motion isodecrement curves were obtained. This type of analysis can be used to predict preflutter behavior during flutter testing and to predict postflutter behavior for use in the design of flutter suppression systems. Author

N78-28482*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF A HYBRID, ANISOTROPIC, MULTILAYERED, QUADRILATERAL FINITE ELEMENT
James C. Robinson and Charles L. Blackburn (Tenn. Univ. at Nashville) Aug. 1978 31 p refs
(NASA-TP-1236; L-12113) Avail: NTIS HC A03/MF A01 CSCL 02K

A multilayered finite element with bending-extensional coupling is evaluated for: (1) buckling of general laminated plates; (2) thermal stresses of laminated plates cured at elevated temperatures; (3) displacements of a bimetallic beam; and (4) displacement and stresses of a single-cell box beam with warped cover panels. Also, displacements and stresses for flat and spherical orthotropic and anisotropic segments are compared with results from higher order plate and shell finite-element analyses. G.G.

N78-28483# Agbabian Associates, El Segundo, Calif.
SUMMARY OF OPERATIONS. DNA MASTER FILE OF GROUND-SHOCK, AIR-BLAST, AND STRUCTURE-RESPONSE DATA Final Report, 1 Oct. 1975 - 30 Sep. 1977
James A. Malthan and K. Thomas Dill 22 Sep. 1977 222 p refs
(Contract DNA001-76-C-0100)
(AD-A053390; AD-E300164; AA-R-7624-6-4443; DNA-4374F) Avail: NTIS HC A10/MF A01 CSCL 09/2

The document presents examples of data processing that were requested by users of the Defense Nuclear Agency Archive of high-explosive test data. Guidelines are also presented that enable data analysts to estimate the computer hours and labor hours that will be required to perform certain typical data processing operations. Author (GRA)

N78-28484# Kaman Avidyne, Burlington, Mass.
ANALYTICAL PREDICTIONS AND CORRELATION WITH EXPERIMENTS FOR THERMAL/BLAST EXPOSURE OF AIRCRAFT PANELS Final Report, 15 Dec. 1975 - 30 Sep. 1976
Raffi P. Yeghiayan Jul. 1977 96 p refs
(Contract DNA001-75-C-0179)
(AD-A053389; AD-E300171; KA-TR-142; DNA-4446F) Avail: NTIS HC A05/MF A01 CSCL 01/3

A study of the effects of thermal/blast exposure on representative aircraft panels was carried out. Pre-test planning and analytic predictions were carried out and compared with the experimental results obtained. Correlation with experimental results was good for the individual effects of internal pressurization or blast overpressure on panels, but correlation proved to be a difficult task for experiments involving thermal exposure, which have a low confidence level. GRA

N78-28485# SRI International Corp., Menlo Park, Calif.
RESPONSE OF EARTH PENETRATOR STRUCTURES IN ANGLE-OF-ATTACK IMPACTS Final Report, 1 Nov. 1975 - 31 Oct. 1976
J. D. Colton, H. E. Lindberg, R. E. Emerson, and J. K. Gran Jun. 1977 126 p refs
(Contract DNA001-74-C-0140)
(AD-A053462; AD-E300175; DNA-4361F) Avail: NTIS HC A07/MF A01 CSCL 19/1

An analysis based on a one-dimensional beam-mass model was developed to predict the early-time response of penetrator structures in angle-of-attack impacts. The model was verified by comparison with the strain response measured in a reverse ballistics test and with the strain response measured in idealized scale model penetrators. Loads were simulated by a device that produces the resultant force-time history near the front end of the penetrator. The tests indicated that the loader could be built in a larger size to test full-scale penetrators. The analysis was then used to investigate penetrator response. It was found that the peak compressive strain, which determines whether or not the penetrator casing fails, depends on the magnitude of the lateral load produced by impacts at an angle of attack, the load rise time (which is inversely proportional to impact velocity), and the relative mass of the nose and aft sections. Finally, a procedure was devised to characterize the strength of penetrator structures in terms of impact velocity and angle of attack. The resulting critical impact curves can be used to make tradeoffs among structural dimensions (e.g., length and wall thickness), to select the best structure for a particular applications, and to provide a framework for planning and interpreting experiments and more detailed calculations. GRA

N78-28486# Naval Intelligence Command, Washington, D. C. Translation Div.
EFFECTS OF ENERGY PER-UNIT LENGTH ON THE STRUCTURE AND HARDNESS OF THE METAL IN THE WELD-AFFECTED ZONE IN WELDING ALPHA-Ti ALLOY
G. L. Petrov and M. D. Shchipkov 10 Mar. 1978 9 p refs
Transl. into ENGLISH of Tr. Leningr. Poli Tekhn. Inst. im. M. I. Kalinina (USSR), no. 245, 1965 p 59-65
(AD-A053502; NISC-TRANS-4006) Avail: NTIS HC A02/MF A01 CSCL 11/6

Weldments of technical-grade titanium and some of its alloys can have lower mechanical properties in the weld-affected zone as a result of structural transformations. According to data provided by a number of authors, sections of the weld-affected zone heated in the process of welding to temperatures above polymorphous transformations Ti-alpha to Ti-beta develop grain growth and the metal in this zone after cooling off may show lower plasticity. The strength properties of the metal in this zone either increase somewhat (at high cooling rates) or decrease (at low cooling rates). GRA

N78-28487# Georgia Inst. of Tech., Atlanta. School of Engineering Science and Mechanics.
FINITE ELEMENT ELASTIC-PLASTIC ANALYSIS OF CRACKS Final Report, 1 Feb. 1974 - 1 Feb. 1978
Satya N. Atluri Mar. 1978 47 p refs
(Grant AF-AFOSR-2667-74; AF Proj. 2307)
(AD-A053660; GIT-ESM-78-2; AFOSR-78-0756TR) Avail: NTIS HC A03/MF A01 CSCL 20/11

This is a summary of research performed in the areas: (1) development of two-dimensional hybrid finite element procedures to calculate stress intensity factors corresponding to general r to the minus alpha in isotropic as well as anistropic materials; (2) study of the convergence of the assumed displacement hybrid finite element procedure in fracture mechanics

problems; (3) development of a three-dimensional hybrid finite element procedure to calculate the elastic combined mode stress-intensity factors K1, K2 and K3 that vary along an arbitrarily curved three-dimensional crack front; (4) hybrid finite element solutions of fundamental three-dimensional crack problems; (5) development of a two-dimensional finite element procedure for analyzing plane problems of fracture involving large-scale yielding conditions and under cyclic loading; (6) study of the J-integral as a ductile fracture initiation condition; (7) studies of finite deformation effects near the crack-tip; (8) analysis of stable crack growth under rising load and study of criteria for loss of stability of growth in ductile materials; and (9) elastic-plastic analysis of effects of crack closure on fatigue crack growth rates. Author (GRA)

N78-28488# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.

THE STRESS FIELD CREATED BY A CIRCULAR SLIDING CONTACT ON-TRANSVERSELY ISOTROPIC SPHERES M.S. Thesis

Dale Bruce Mowry Jun. 1978 63 p refs

(AD-A053521) Avail: NTIS HC A04/MF A01 CSCL 20/11

The field equations for a transversely isotropic half-space are defined in terms of potential functions. A form of the potential functions satisfying equilibrium is assumed and the boundary value problem of a tangentially loaded spherical indentor on the half-space is solved. Expressions are obtained defining the radius of no-slip for the static case, and the relationship between the horizontal surface displacement under the indentor and the horizontally applied force. Stresses for tangential loading are superposed with those previously obtained for normal loading of the indentor, and the stress field is defined in the half-space and on the surface for both static and sliding cases. Von Mises: criteria for the sliding case is calculated and plotted in the half-space and on the surface for two transversely isotropic metals using two separate coefficients of limiting friction, and on the surface for the static case for magnesium with a coefficient of limiting friction of .5. Author (GRA)

N78-28489# Texas Univ. at Austin.

AN EXPLORATORY PHOTOELASTIC INVESTIGATION OF POST-TENSIONED CONCRETE ANCHORAGE ZONE BURSTING STRESSES M.S. Thesis

Stephen Douglas Vaughn Aug. 1977 206 p refs

(AD-A053516) Avail: NTIS HC A10/MF A01 CSCL 13/3

The use of post-tensioning prestressed concrete members is becoming increasingly popular in the United States. Problems have arisen in the design of the anchorage zones of these members, however, as the post-tensioning force has caused cracking in several instances. The anchorage zone itself is a complicated stress region influenced by many different factors. While there have been numerous analytical studies of the stresses present in the anchorage zone, a general lack of insight into the nature of stresses present and the influence of various parameters on their distribution persists. The exploratory investigation reported herein was undertaken to more closely examine the stresses found in the anchorage zone, utilizing the analysis method of photoelasticity. The investigation was to design an appropriate photoelastic model, develop appropriate testing procedures, and then conduct a series of tests varying anchorage zone parameters to determine their influence on the stresses created in the anchorage zone. GRA

N78-28490# Argonne National Lab., Ill.

COMPUTING THE EFFECT OF PLASTIC DEFORMATION OF PIPING ON PRESSURE TRANSIENT PROPAGATION

C. K. Youngdahl and C. A. Kot 1977 15 p Presented at Winter Ann. Meeting of the Amer. Soc. of Mech. Eng., Atlanta, Georgia, 27 Nov. 1977

(Contract W-31-109-eng-38)

(CONF-771120-20) Avail: NTIS HC A02/MF A01

The computer program PTA-1 performs pressure transient analysis of large piping networks using the one dimensional method of characteristics applied to a fluid hammer formulation. The effect of elastic plastic deformation of piping on pulse propagation is included in the computation. Each pipe is modeled as a series of rings, neglecting axial effects, bending moments, and inertia. The fluid wave speed is a function of pipe deformation and, consequently, of position and time. Comparison with existing experimental data indicate that this simple fluid structure interaction model gives surprisingly accurate results for both pressure histories in the fluid and strain histories in the piping. ERA

N78-28491# Bettis Atomic Power Lab., West Mifflin, Pa.

CYCLE COUNTING PROCEDURE FOR FATIGUE FAILURE PREDICTIONS FOR COMPLICATED MULTI-AXIAL STRESS HISTORIES

D. P. Jones, C. M. Friedrich, and R. G. Hoppe Dec. 1977 33 p refs Presented at ASME Energy Technol. Conf. on Composites in Pressure Vessels and Piping, Houston, Tex., 18 Sep. 1977

(Contract EY-76-C-11-0014)

(WAPD-T-2674; Conf-770903-8) Avail: NTIS HC A03/MF A01

The procedure was a generalization of the rainflow method developed by Matsuishi and Endo for one dimensional situations. It provided a consistent treatment of three dimensional stress states that is especially suited to computer programming applications for the post-processing of finite element stress data. The procedure included a unique method to account for the rotation of principal stresses with time during the stress history and for the cumulative fatigue damage resulting from partial stress reversals within a stress cycle. The general procedure and necessary equations for programming are presented. Comparisons show that the cycle counting method provides a consistent unambiguous interpretation of the fatigue design procedure in the ASME Code for these cases. Finally, the fatigue life of a perforated plate, as analyzed by finite elements, is computed for the combination of several hypothetical stress histories. ERA

N78-28492# Sandia Labs., Livermore, Calif.

STRESS INTENSITY FACTOR CALCULATIONS OF AN INTERNAL RADIAL EDGE CRACK IN A CYLINDRICAL TUBE USING QUARTER-POINT FINITE-ELEMENT ANALYSIS WITH J-INTEGRAL TECHNIQUES

Y. R. Kan Feb. 1978 28 p refs

(Contract EY-76-C-04-0789)

(SAND-77-8290) Avail: NTIS HC A03/MF A01

The stress intensity factors, K/sub I/, and compliances for an internal radial crack in a cylindrical tube subjected to a uniform internal pressure and external loading conditions are calculated using the quarter-point finite element analysis and J-integral techniques. The results are graphically presented as a function of crack length. Under a uniform internal pressure, the K/sub I/ obtained by this analysis agrees with the exact K/sub I/ calculated by a closed form solution with 1.5 percent. An unexpected result was that K/sub I/ reached a maximum before the crack reached the outer wall for the case of a pair of collinear external forces applied in the direction of the radial crack. The magnitude and the location where the peak K/sub I/ occurs, was verified by a simplified curved beam model. ERA

N78-28493# Oak Ridge National Lab., Tenn.

STABLE AND UNSTABLE CRACK GROWTH IN PRESSURE VESSEL MODELS

G. C. Smith, D. A. Canonico, and W. J. Stelzman 1978 24 p refs Presented at 107th AIME Meeting, Denver, 26 Feb. 1978

(Contract W-7405-eng-26)

(CONF-780213-3) Avail: NTIS HC A02/MF A01

Identical steel pressure vessels with 254 mm (10-in) dia, 38 mm (1.5 in.) wall thicknesses and long, deep machined and sharpened axially oriented flaws were tested at three different temperatures. The vessels were assembled by electron beam welding cylindrical sections with substantially different toughnesses due to different heat treatments. Crack extension initiated in relatively brittle sections, and the cracks extended both stably and unstably, depending on test temperature, toward the tougher sections where crack arrest did and did not occur. Charpy impact specimens and both slow bend and dynamic precracked Charpy specimens were used for material characterization. The behavior of the vessels is described and related to the Charpy data. ERA

N78-28494# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

REVIEW OF AERONAUTICAL FATIGUE INVESTIGATIONS IN THE NETHERLANDS DURING THE PERIOD APRIL 1975 TO FEBRUARY 1977

J. Schijve Feb. 1977 43 p refs Presented at the 15th ICAF Conf., Darmstadt, West Ger., 9-10 May 1977

(NLR-MP-77005-U) Avail: NTIS HC A03/MF A01

The review, consisting of summaries of the Dutch contribution to the 15th ICAF conference, May 1977, covers: loads; flight simulation testing procedures; fatigue investigations; residual strength; and materials evaluations. ESA

N78-28495# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

EFFECTS OF CRACK PLANE ORIENTATION TRANSITIONS ON FLIGHT SIMULATION FATIGUE CRACK PROPAGATION IN A HIGH STRENGTH ALUMINIUM ALLOY (7050)

R. J. H. Wanhill and L. Schra Oct. 1976 23 p refs

(Contract NIVR-1806)

(NLR-TR-76130-U) Avail: NTIS HC A02/MF A01

The effects of flat to slant fracture transitions on flight simulation fatigue crack propagation in specimens of 7050 aluminum alloy forgings are discussed. For specimens containing flat, shear-lipped, or full slant fractures at similar crack lengths the crack resistance (R curve) approach appears to provide an explanation for differences in the static crack growth increments induced by peak loads. The results emphasize the complexity of fatigue under realistic loading and add another variable to environmental effects. Author (ESA)

N78-28496# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

EXTENSIONS TO THE ELASTOPLASTIC PART OF ASKA. MATERIAL LAWS, BENDING ELEMENTS

H. A. Balmer and J. S. Doltsinis 1977 75 p refs

(ISD-204) Avail: NTIS HC A04/MF A01

The theoretical background of the latest additions to the elastoplastic part of ASKA is presented. The material laws are dealt with. In view of the several types of material behavior to be included (Bauschinger effect, hydrostatic dependence of the yield condition), a unified treatment - at least to a certain extent - proved useful. The unification is reflected in the fact that the von Mises concept of equivalent stress/equivalent plastic strain, which already formed the basis of the formulation used in the original elastoplastic ASKA version, could be retained throughout. This facilitated the expansion of the existing program system considerably. As regards the elastoplastic bending elements (plate/shell and related stiffener) it was found advisable - particularly in the case of plates and shells - to rely on well established and tested elastic bending elements such as the TRIB3, rather than devise a completely new element. The mechanical model associated with the elastoplastic stress/strain behavior across the thickness of the shell thereby emerged in a simple manner directly from the inherent structure of the original element, and thus required only few program alterations.

Author (ESA)

N78-28497# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction Scientifique de la Resistance des Structures.

PREDICTION OF SATELLITE SUBSTRUCTURE RESPONSE TO ACOUSTIC EXCITATION. VOLUME 1: APPLICATION OF THE DYNAMIC STATISTICAL APPROACH TO THE PREDICTION STUDY OF THE DYNAMIC CHARACTERISTICS OF SATELLITE SUBSTRUCTURE ASSEMBLIES AND OF THEIR VIBRATORY BEHAVIOR IN A RANDOM DIFFUSE ACOUSTIC ENVIRONMENT Final Report [APPLICATION DE L'APPROCHE DYNAMIQUE STATISTIQUE A L'ETUDE PREVISIONELLE DES CARACTERISTIQUES DYNAMIQUES D'ASSEMBLAGES DE SOUS-STRUCTURES DE SATELLITES ET DE LEUR COMPORTEMENT VIBRATOIRE DANS UNE AMBIANCE ACOUSTIQUE ALEATOIRE DIFFUSE]

A. Bourgine, R. Tretout, P. Monteil, and J. P. Robichon ESA Dec. 1977 240 p refs In FRENCH 4 Vol.

(Contract ESTEC-2511/75-PP)

(RTS-5/3277-Vol-1; ESA-CR(P)-1048-Vol-1) Avail: NTIS HC A11/MF A01

The possibility of predicting the vibratory behavior, in a vast spectral domain, of satellite structures consisting of assemblies of various substructures in a random diffuse acoustic environment was studied. In the theoretical part, in which the dynamic statistical approach is used, the problem of solving assembly problems also with respect to forecasting structural characteristics is treated. The calculation of vibration transfer between structure and equipment is dealt with. Experiments performed with a satellite substructure consisting of three elements are described. The software used in the study is presented. ESA

N78-28498# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction Scientifique de la Resistance des Structures.

PREDICTION OF SATELLITE SUBSTRUCTURE RESPONSE TO ACOUSTIC EXCITATION. VOLUME 2: USER AND PROGRAMMING MANUAL OF THE PRA SOFTWARE FOR THE CASCADE ASSEMBLY OF SUBSTRUCTURES AND FOR THE CALCULATION OF THE RESPONSE OF A STRUCTURE TO AN ACOUSTIC ENVIRONMENT Final Report [MANUELS D'UTILISATION ET DE PROGRAMMATION DU LOGICIEL PRA D'ASSEMBLAGE EN CASCADE DE SOUS-STRUCTURES ET DE CALCUL DE LA RESPONSE D'UNE STRUCTURE A UN ENVIRONNEMENT ACOUSTIQUE]

P. Monteil and G. LeDeunff ESA Jan. 1978 191 p In FRENCH 4 Vol.

(Contract ESTEC-2511/75-PP)

(RTS-6/3277-Vol-2; ESA-CR(P)-1048-Vol-2) Avail: NTIS HC A09/MF A01

The PRA program permits the semi-automatic calculation of the acoustic response of a structure from its dynamic characteristics: it takes into account the principal arithmetic operations of the spectra, the trajectories, and also the calculation of certain predictive functions. It provides a link with the programs SET and ASS. A complete description of the PRA computer program, including input file, output file, user commands, necessary fields, possible values, error messages and meanings, and memory requirement is given. All subroutines of the program are listed. ESA

N78-28499# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction Scientifique de la Resistance des Structures.

PREDICTION OF SATELLITE SUBSTRUCTURE RESPONSE TO ACOUSTIC EXCITATION. VOLUME 3: USER AND PROGRAMMING MANUAL OF THE ASS PROGRAM FOR THE CALCULATION OF DYNAMIC CHARACTERISTICS OF AN ASSEMBLY OF TWO SUBSTRUCTURES FROM THE DYNAMIC CHARACTERISTICS OF THE TWO SEPARATE SUBSTRUCTURES Final Report [MANUELS D'UTILISATION ET DE PROGRAMMATION DU LOGICIEL ASS DE CALCUL DES CARACTERISTIQUES DYNAMIQUES D'UN ASSEMBLAGE DE DEUX SOUS-STRUCTURES CONNAISSANT LES CARACTERISTIQUES DYNAMIQUES DE CES DERNIERES PRISES ISOLEMENT]

P. Monteil ESA Jan. 1978 85 p In FRENCH 4 Vol.

(Contract ESTEC-2511/75-PP)

(RTS-7/3277-Vol-3; ESA-CR(P)-1048-Vol-3) Avail: NTIS HC A05/MF A01

The ASS program permits the calculation of the dynamic characteristics of a structure consisting of an assembly of two substructures. The calculation is performed (IRIS 80) with machine readable data (spectra and frequencies) obtained from tests. The number of data is optimized using nymetric and hermicity properties of certain matrices. One calculation is performed in one run of the data processing routines, but several calculations can be performed during the same job. A complete description of the program, including files used, memory requirement, command cards, error messages, and meanings, is given. All subroutines of the program are listed. ESA

N78-28500# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction Scientifique de la Resistance des Structures.

PREDICTION OF SATELLITE SUBSTRUCTURE RESPONSE TO ACOUSTIC EXCITATION. VOLUME 4: USER AND PROGRAMMING MANUAL OF THE SET PROGRAM FOR THE CALCULATION OF STRUCTURE-EQUIPMENT TRANSFER Final Report [MANUELS D'UTILISATION ET DE PROGRAMMATION DU LOGICIEL SET DE CALCUL DE

TRANSFERT STRUCTURE - EQUIPMENT]
P. Monteil ESA Jan. 1978 50 p In FRENCH 4 Vol.
(Contract ESTEC-2511/75-PP)
(RTS-8/3277-Vol-4; ESA-CR(P)-1048-Vol-4) Avail: NTIS HC A03/MF A01

The SET program permits the calculation of the acoustic response of equipment mounted on a structure from machine readable data, in random order, obtained from tests. The calculation is performed (IRIS 80) in one run and it is up to the user to define and to collect on input cards the test data to be used for data processing. A complete description of the program, including files used, memory requirements, on input cards the test data to be used for data processing. A complete description of the program, including files used, memory requirements, command cards, error messages, and meanings, is given. ESA

N78-28048 European Space Agency, Paris (France).
TWO-AXIS TENSILE TEST MACHINE FOR STATIC AND DYNAMIC TESTS
Madeleine Chaudonneret, Philippe Gilles, Roger Labourdette, and Humbert Policella *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-5 (ESA-TT-459) May 1978 p 67-76 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-5, Sep.-Oct. 1977 p 299-305 Original report in FRENCH previously announced as A78-16621 (For primary document see N78-28044 19-01)
Avail: NTIS HC A06/MF A01

N78-28049 European Space Agency, Paris (France).
EXPERIMENTAL CHARACTERIZATION OF MATERIALS UNDER CYCLIC LOADING AT HIGH TEMPERATURE
Jean-Louis Chaboche and Humbert Policella *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-5 (ESA-TT-459) May 1978 p 77-108 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-5, Sep.-Oct. 1977 p 307-324 Original report in FRENCH previously announced as A78-16622 (For primary document see N78-28044 19-01)
Avail: NTIS HC A06/MF A01

42 GEOSCIENCES (GENERAL)

N78-28501# World Meteorological Organization, Geneva (Switzerland).
SOLAR ENERGY
1977 709 p refs Proc. of the UNESCO/WMO Symp., Geneva, 30 Aug. - 3 Sep. 1976
(WMO-477; ISBN-92-63-10477-8) Avail: NTIS HC A99/MF A01

Selected papers on solar energy are discussed. They include monitoring solar radiation for solar energy, solar radiation on inclined surfaces, meteorological data in different regions, measurement and evaluation of radiation data, planning and coordination, general aspects of utilization of solar energy and energy production, solar electricity, and fuel production. For individual titles, see N78-28502 through N78-28557.

N78-28502# National Oceanic and Atmospheric Administration, Silver Spring, Md.
MONITORING SOLAR RADIATION FOR SOLAR ENERGY **c92**
Lester Machta *In* WMO Solar Energy 1977 p 1-35 refs (For primary document see N78-28501 19-42)
(Grant NSF AFR-75-17303)
Avail: NTIS HC A99/MF A01

Requirements for solar energy monitoring are reviewed. These include instruments, type of users, accuracy and network requirements, insolation data requirements, and scientific requirements for solar radiation data related to a comprehensive solar energy program. A method is suggested which corrects past insolation data. This method compares actual observations for clear solar noon with those estimated from other observations or from theory. Global solar radiation estimates are derived using sunshine or cloud information either through regression analysis or from theoretical calculations. The need for providing users with data on solar radiation falling on inclined surface, requiring the separation of direct and diffuse components from the global solar radiation, is emphasized. ESA

N78-28503# Leningrad (A. A. Zhdanov) State Univ. (USSR).
RADIATION REGIME OF INCLINED SURFACES **c44**
K. Y. Kondratyev and M. P. Fedorova *In* WMO Solar Energy 1977 p 36-61 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

The problem consists in determining fluxes of direct solar, scattered, and global radiation income to inclined surfaces and in assessing the radiation balance of inclined surfaces factor important to the successful operation of solar power installations. Investigations on the radiation regime of inclined surfaces show that their radiation balance components can be determined from the radiation balance components for the horizontal surface using the corresponding computation methods and empirical relations. This approach is very significant because of availability of data on the radiation regime of horizontal surfaces. ESA

N78-28504# World Meteorological Organization, Geneva (Switzerland).
USE OF EXISTING METEOROLOGICAL INFORMATION FOR SOLAR ENERGY APPLICATION **c47**
Lars Dahlgren *In its* Solar Energy 1977 p 62-65 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

A solar energy research and development program is described the objectives of which are to determine the quantitative relationship between measurements of solar radiation and other relevant meteorological parameters and to develop an internationally uniform system of presentation of solar radiation data in order to facilitate calculations for utilizing solar energy. Selected problems related to the project are presented and solutions proposed. ESA

N78-28505# British Columbia Univ., Vancouver.
CLIMATOLOGICALLY RELATED PROBLEMS IN DETERMINING THE POTENTIAL FOR SOLAR ENERGY UTILIZATION IN CANADA **c47**
John E. Hay *In* WMO Solar Energy 1977 p 66-79 refs Sponsored in part by Natl. Res. Council of Can. and Can. Atmospheric Environ. Serv. (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

Many problems related to the climatology of solar radiation arise when assessing the feasibility of utilizing solar energy for domestic space and hot water heating. Many of these problems are attributed to the spatial and temporal variability of the solar radiation incident on the earth surface. It is shown that these problems can be overcome by an appropriate analysis of the data or by an appropriate design of the solar energy system. ESA

N78-28506# Hamburger Sternwarte (West Germany).
VARIATION OF SOLAR AND TERRESTRIAL RADIATION WITH TIME OF THE DAY AND TIME OF THE YEAR AS DEDUCED FROM MANY YEARS RECORDS **c92**
F. Kasten *In* WMO Solar Energy 1977 p 80-88 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

At the Hamburg Meteorological Observatory a 20-year record of daily sums and a 10-year record of hourly sums of global solar radiation, sky radiation, atmospheric radiation, as well as radiation reflected and emitted from the ground, were recently completed. The mean daily course of the hourly sums for each month of the year and the mean yearly course of the daily sums of these measured fluxes and of radiation quantities derived thereof, e.g., direct solar, net solar, net terrestrial and net total radiation, albedo, etc., are presented. Author (ESA)

N78-28507# Singapore Univ.
SOLAR RADIATION MODEL BUILDING WITH DATA OF NON-UNIFORM RELIABILITY AND COMPLETENESS **c92**
T. N. Goh and K. J. Tan *In* WMO Solar Energy 1977 p 89-99 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

A forecasting model developed from a given amount of solar radiation data recorded for 14 years (1961 to 1974) at Singapore is described. A set of complete and reliable data was used to refine a model derived from less detailed data of a longer record period. The final model satisfies the statistical criteria required for forecasting and consists of deterministic, stochastic, and meteorological forecast components, each having particular significance, respectively, for long, short, and intermediate lengths of forecast lead time. The procedure is readily adaptable to a general case, the only major change to be expected being at the stochastic modeling stage, where the model form and parameter values are a reflection of the pattern and extent of the influence of weather changes on solar radiation received in the region in question. Future research effort should be directed towards methods for model updating, especially for the stochastic component. Author (ESA)

N78-28508# World Meteorological Organization, Geneva (Switzerland).

THE AVAILABILITY OF SOLAR ENERGY AT THE EASTERN MEDITERRANEAN **c92**

A. Manes and A. Teitelman *In its* Solar Energy 1977 p 100-113 refs (For primary document see N78-28501 19-42)

Avail: NTIS HC A99/MF A01

The availability of solar energy is presented in terms of daily totals of global solar radiation actually measured at the station network in the area. It is shown that the distribution of daily global radiation deviates strongly from a normal pattern, especially during the summer months. Maps of the 5th, 25th, 50th, 75th, and 95th percentiles of daily solar radiation are presented for the four seasons. A well pronounced longitudinal gradient is apparent in the coastal areas of the eastern Mediterranean due to the influence of marine air enhancing cloudiness. It passes gradually to a latitudinal gradient typical for continental arid and desert areas. The relatively higher values over mountains in the area are well pronounced during summer and transition seasons. Extremely high values of daily global radiation were recorded at the Santa Katherina area of the Sinai Peninsula. The 95th percentile for June reaches a value as high as 850 langleys per day. In winter the daily solar radiation over the mountainous regions is reduced due to enhanced cloudiness caused by orographic effects. Author (ESA)

N78-28509# World Meteorological Organization, Geneva (Switzerland).

A DETAILED STUDY OF SOLAR RADIATION AND POTENTIAL PHOTOSYNTHESIS **c92**

G. O. P. Obasi and N. N. P Rao *In its* Solar Energy 1977 p 114-124 refs (For primary document see N78-28501 19-42)

Avail: NTIS HC A99/MF A01

Up to date mean monthly maps of the distribution of glonal radiation in Kenya are presented. The data used for the analyses include those acquired from stations equipped with Eppley and Kipp fyranometers, calibrated Gunn Bellani radiation integrators, and those derived indirectly from stations with good and reliable records of sunshine hours and cloudiness to supplement data from areas where the radiation network is sparse. Using these maps, and a slightly modified technique of Monteith's method of estimating potential photosynthesis, an estimate of the actual net photosynthesis over Kenya was made. The potential photosynthesis presents an estimate of the size of crop yields that can be obtained from a particular locality in Kenya. Suggestions are given for the utilization of solar energy in Kenya both for power production and for maximization of crop yields and for their storage as biomass in forests. Author (ESA)

N78-28510# World Meteorological Organization, Geneva (Switzerland).

RADIATION MEASUREMENTS FOR SOLAR ENERGY APPLICATIONS **c92**

Anna Mani *In its* Solar Energy 1977 p 125-143 refs (For primary document see N78-28501 19-42)

Avail: NTIS HC A99/MF A01

The results of radiation measurements made over the tropics and the arid and semi-arid subtropics of the world using ground based and satellite borne sensors are summarized. It is shown that solar energy of the order of 7 kWh/sq m is received daily at stations in the arid regions, with durations of sunshine exceeding 3,600 hours a year. Diffuse radiation from even cloudless skies is not insignificant, being as high as one fifth that of global radiation from sun and sky. The temporal and spatial distribution of all components of solar radiation is also discussed. While values of solar radiation, computed theoretically or estimated from sunshine duration or cloudiness data, may be adequate for the conversion of solar energy by means of low grade thermal devices, more precise measurements, particularly in specified spectral regions of the solar spectrum, are necessary for the direct conversion of solar energy into electrical energy using semiconductor devices or the biological conversion of solar energy into transportable fuel. The various instruments and techniques in use for the measurements of all parameters of importance, such as the duration of bright sunshine, direct solar radiation at normal incidence and on inclined surfaces, and direct, global, diffuse, and reflected solar radiation for the whole spectrum and in selected spectral intervals are discussed. The degree of accuracy of solar radiation data needed in connection with the use of solar energy is also discussed. Author (ESA)

N78-28511# World Meteorological Organization, Geneva (Switzerland).

FIRST RESULTS OBTAINED FROM THE SWISS MOBILE SYSTEM FOR SOLAR RADIATION MEASUREMENTS **c92**

A. Heimo and P. Valko *In its* Solar Energy 1977 p 144-152 refs (For primary document see N78-28501 19-42)

Avail: NTIS HC A99/MF A01

An autocar, equipped with a number of different radiation measuring instruments was set in operation at various locations in Switzerland during the last two years. By using seven pyranometers movable with step-motors in any position this mobile system permits the determination of global radiation falling on arbitrarily orientated and inclined plane surfaces. The direct solar radiation on a normal surface was measured in the total spectrum, the three broad spectral ranges of the Schott filters OG1, RG2, and RG3 and also at 12 quasi-monochromatic wavelengths. Terrain properties and cloudiness distribution were recorded by a 180 deg (fish-eye)-camera. By these means also the diffuse radiation flux on 77 differently orientated and tilted planes was determined in several hundred cases for each plane. The dependence of the global and diffuse radiation intensities on solar height, atmospheric turbidity, cloudiness, terrain characteristics and on the orientation and inclination of the plane are discussed. Instruments for determining the intensity distribution of the radiation density over the sky hemisphere in the total spectrum as well as for spectral scanning in the sun's vertical to get the polarization parameters of sky radiation, are under construction. Author (ESA)

N78-28512# World Meteorological Organization, Geneva (Switzerland).

SOLARIMETRY BY SATELLITES IN THE AMAZON REGION **c92**

A. W. AlbinodeSousa *In its* Solar Energy 1977 p 153-161 refs (For primary document see N78-28501 19-42)

Avail: NTIS HC A99/MF A01

A project to evaluate the resolution obtained from geostationary satellite (NOAA 4) pictures in the visible and infrared range using data on net solar radiation, temperature, and humidity recorded from Brazilian solar stations is presented. First results obtained are discussed. ESA

N78-28513# Universidad Nacional Autonoma de Mexico, Villa Obregon.

ON THE NUMERICAL COMPUTATION OF SOLAR RADIATION PARAMETERS FROM SATELLITE CLOUD DATA **c92**

E. Hernandez *In* WMO Solar Energy 1977 p 162-170 refs (For primary document see N78-28501 19-42)

Avail: NTIS HC A99/MF A01

Three years of satellite cloud cover data were used to estimate the monthly and annual mean values of the duration and intensity of insolation at 117 regions of Mexico. With only the knowledge of the monthly and annual regional percentages of cloudless and partially cloudy days, an approximation was done of the monthly and annual mean values of the relative duration of insolation. The Fritz formulae were used to obtain the maximum global radiation that can be expected on cloudless

days. Both the relative duration of insolation and the maximum global radiation values were related to interpolated values of the quasilinear approximation of Angstrom's equation. The obtained monthly and annual mean values of the real global radiation were mapped. The corresponding isoradiation lines show contours that have a remarkable continuity with those found for the U.S. The results obtained permit a study of the best place-time areas for the future development of solar energy applications and contribute to the knowledge of the solar climatology of the country. Author (ESA)

N78-28514# International Institute for Applied Systems Analysis, Laxenburg (Austria).
DIRECT RADIATION DATA FORMULATION FROM GLOBAL RADIATION AND OTHER GIVEN MEASUREMENTS, USING A COMPUTER AIDED METHOD **c92**
N. Weyss *In* WMO Solar Energy 1977 p 171-181 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

A computer aided procedure developed to integrate solar insolation data for selecting sites and evaluating potential heliostat fields in Austria is described. Its main feature is the combination of limited local registration data for a certain site evaluation with the complete data pattern of another station. The data on global and diffuse sky radiation were recorded at the Vienna, Salzburg, and Sonnblick weather stations. Thirds of a month were chosen as units for calculation periods. Tests were made for various years, station distances, and alpine altitudes. ESA

N78-28515# Melbourne Univ., Parkville (Australia).
SOLAR RADIATION MODELS FOR USE IN SOLAR ENERGY SYSTEMS SIMULATION **c44**
W. W. S. Charters and R. B. Vokach-Brodsky *In* WMO Solar Energy 1977 p 182-190 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

Results of work on solar radiation models especially needed in system simulation to allow prediction of the performance of a solar power plant are presented. The available data in Australia for use in solar energy system simulation are surveyed. Possible errors which can occur in the magnitude of the predicted radiation on an inclined surface through the use of the currently available data are estimated. Emphasis is laid on the need for additional extensive short term radiation data on which to base long term radiation models. Author (ESA)

N78-28516# Institut Royal Meteorologique de Belgique, Brussels.
COMPUTER PROCEDURE FOR ACCURATE CALCULATION OF RADIATION DATA RELATED TO SOLAR ENERGY UTILIZATION **c44**
R. Dogniaux *In* WMO Solar Energy 1977 p 191-197 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

A set of mathematical expressions which directly yield quantities of direct, diffuse, global, and reflected components of solar irradiance and illuminance for clear sky conditions and for overcast sky is presented. The method lends itself to programming for computer calculation, taking into account the parameters of latitude, date, time, conditions of atmospheric turbidity, and orientation and inclination of receiving surface. By ponderation of the two extreme conditions (clear sky and overcast sky) by weighted factors associated to the duration of sunshine, it is possible to derive standard radiation data for any typical reference period longer than 10 days. Comparisons of the predicted data with recorded observations were tested at different stations in Belgium, France, Budapest, and Oran. Author (ESA)

N78-28517 World Meteorological Organization, Geneva (Switzerland).
MATHEMATICAL APPROXIMATIVE EQUATIONS FOR SOLAR RADIATION INCIDENTAL TO A DETERMINED SITE **c92**
Julio R. Hirschmann *In its* Solar Energy 1977 p 198-209 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

Using continuous daily measurements of incidental solar radiation and solar distilled water, carried out for one year at the Solar Distillation Experimental Plant in the Quillague Village, situated in the north of Chile, the validity of a mathematical model expressing the variation of the solar radiation incidental to a determined site as a cosinal function of the days of the year was demonstrated. It is concluded that the use of the cosine function as mathematical expression for modeling processes of solar energy utilization in general and expecially for variation of incidental solar radiation is appropriate. ESA

N78-28518# World Meteorological Organization, Geneva (Switzerland).
SOLAR ENERGY POTENTIAL IN MOUNTAINOUS TERRAIN **c44**
Inge Dirmhirn *In its* Solar Energy 1977 p 211-218 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

Mountainous terrain provides a special radiation climate that can be of advantage for solar energy conversion. Parameters influencing the general radiative climate are determined by the meso-scale of the locations. The major parameters are discussed and their respective influence on the radiative climate demonstrated using data recorded at various Alpine areas. Grid size for radiation networks has to be reduced in mountainous terrain, but general features of deviations versus plains can be derived from planned short term recordings at selected locations. Author (ESA)

N78-28519# United Nations Environment Program.
SOLAR ENERGY APPLICATIONS FOR THE ARID AREAS **c44**
Bertrand Chatel *In* WMO Solar Energy 1977 p 219-225 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

In April 1975, an inter-agency fact-finding mission visited some of the Sahelian countries to collect facts about possible applications of solar energy to solve the most urgent problems of drought stricken countries such as Senegal, Gambia, Mauretania, Upper Volta, Mali, and Niger. The mission found that useful applications could be developed, notably for pumping underground water and generating small outputs of electric power for villages. Other useful devices would include water heaters to replace the present burning of scarce wood for cooking, solar distillers, food dryers, and refrigeration equipment for food conservation and the cooling of buildings. The grinding of cereals by solar electricity would be a particularly useful labor-saving equipment. The Advisory Committee on the Application of Science and Technology to Development has urged the use of nonconventional sources of energy (solar, wind, and biological energy conversion) for many applications in developing countries. Author (ESA)

N78-28520# World Meteorological Organization, Geneva (Switzerland).
SOLAR ENERGY RESEARCH AND DEVELOPMENT IN INDIA **c44**
A. Ramachandran *In its* Solar Energy 1977 p 226-232 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

Areas of utilization of solar energy and wind power in India can be divided into the following different categories: rural sector, urban sector, and special applications such as salt production, metallurgical furnaces. and milk and paper industries, desalinated process water supply to coastal industries, etc. For this purpose a national energy research committee was constituted and a national integrated program drawn up. The various aspects of this program include solar insolation mapping, solar thermal devices and wind mills, and photovoltaic conversion. Special mention is made of two other major projects: (1) the solar space heating and (2) the 10 kW solar power plant. ESA

N78-28521# Bandung Inst. of Technology (Indonesia).
FRAMEWORK FOR A SOLAR ENERGY RESEARCH AND DEVELOPMENT POLICY PROPOSED FOR INDONESIA AND ITS RELEVANCE TO SOLAR ENERGY UTILIZATION IN BUILDING SYSTEMS **c44**
Iskandar Danusugondho and Aldy Anwar *In* WMO Solar Energy 1977 p 223-251 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

A framework for a comprehensive and long-range national

policy for the development of solar energy utilization in Indonesia is proposed, introducing a fresh approach and a new orientation into solar energy research, development, and education based on a broad concept of solar energy utilization. An initial study to apply this concept and an approach to develop solar energy utilization in building systems is currently under way at the Bandang Institute of Technology. This program is briefly outlined. Author (ESA)

N78-28522# Mali National Solar Energy Lab., Bamaco (West Africa).

DEVELOPMENT AND USE OF SOLAR ENERGY IN MALI c44

Cheichne Traore *In* WMO Solar Energy 1977 p 252-258 (For primary document see N78-28501 19-42)

Avail: NTIS HC A99/MF A01

Activities concentrated mainly on studying means of using solar radiation without prior conversion are presented. They include a program on water heating, industrial heating, solar distillation and steam production, solar drying, solar cookers, and solar pumps. Existing facilities required to carry out the various programs are briefly cited and future requirements mentioned. ESA

N78-28523# World Meteorological Organization, Geneva (Switzerland).

A BRIEF REVIEW OF THE UNITED STATES SOLAR RESOURCE ASSESSMENT PROGRAM c44

Michael R. Riches *In its* Solar Energy 1977 p 259-261 (For primary document see N78-28501 19-42)

Avail: NTIS HC A99/MF A01

The U.S. insolation resource assessment program is briefly outlined including user requirements, data format, data networks, and data estimation. ESA

N78-28524# World Meteorological Organization, Geneva (Switzerland).

NATIONAL SOLAR PROGRAM FOR RESEARCH AND DEVELOPMENT IN ARGENTINA c44

R. Fernandez, L. Saravia, and W. Scheuer *In its* Solar Energy 1977 p 263-271 refs (For primary document see N78-28501 19-42)

Avail: NTIS HC A99/MF A01

A national program for research and development in solar energy, to coordinate the activities of 22 groups belonging to universities, institutes, and federal agencies, and to cover three main areas: (1) conversion to thermal energy (applications to buildings, industry, and agriculture); (2) conversion to other forms of energy (electricity, gas, etc.); and (3) related studies (solar climatology, national solar data center, transfer to industry, socio-economical studies, etc.) is presented. The state-of-the-art in Argentina is briefly described with references to climatological conditions, social needs, and results so far obtained, including their regional implementation. Author (ESA)

N78-28525# World Meteorological Organization, Geneva (Switzerland).

UTILIZATION OF SOLAR ENERGY IN BRAZIL c44

Antonio M. A. MacDowell *In its* Solar Energy 1977 p 272-277 (For primary document see N78-28501 19-42)

Avail: NTIS HC A99/MF A01

The research program on the use of solar energy in Brazil has been guided mainly towards application in the fields of collectors, dryers, stills, refrigeration, heat engines, solar architecture, photovoltaic effect, thermo-mechanical conversion, storage, bioconversion, concentrators, wind energy, and solarimetry. Projects are briefly outlined. ESA

N78-28526# University of the West Indies, Saint Augustine (Trinidad).

SOLAR ENERGY UTILIZATION IN THE WEST INDIES c44

S. Satcunanathan *In* WMO Solar Energy 1977 p 278-291 refs (For primary document see N78-28501 19-42)

Avail: NTIS HC A99/MF A01

Agriculture forms the basis of the economy of most of the twelve territories that comprise the CARICOM states of the Carribean, contributing between 25% and 40% of the G.D.P. and accounting for between 20% and 50% of the labor force. Tourism forms the mainstay in some of the territories and contributes significantly to the national economies in several others. Solar energy utilization in crop drying, water heating, desalination, and refrigeration could therefore be of considerable benefit to these territories. The solar energy research and development work carried out in the region in several relevant areas is reviewed. Author (ESA)

N78-28527# World Meteorological Organization, Geneva (Switzerland).

STATUS OF THE CCMS AND IEA SOLAR ENERGY ACTIVITIES c44

Frederick H. Morse *In its* Solar Energy 1977 p 292-308 ref (For primary document see N78-28501 19-42)

Avail: NTIS HC A99/MF A01

The solar energy pilot study of the NATO CCMS (Committee on the Challenge of Modern Society) is described. An information exchange system was established for exchange of reports on solar energy utilization among participating countries. A systems reporting format for reporting performance of systems and sub-systems in solar energy projects was adopted. The IEA (International Energy Agency) has developed five cooperative projects in the areas of solar heating and cooling of buildings and solar radiation measurements and analysis. The five projects are briefly outlined. ESA

N78-28528# Pahlavi Univ., Shiraz (Iran). Solar Energy Center.

SOLAR ENERGY UTILIZATION RESEARCH IN IRAN c44

Mehdi N. Bahadori *In* WMO Solar Energy 1977 p 309-327 refs (For primary document see N78-28501 19-42)

Avail: NTIS HC A99/MF A01

The solar energy research activities of several universities in Iran up to June 1975 are briefly described. The activities at Pahlavi University in Shiraz include the development of solar air heaters, water heaters, steam cookers, dehydrators desalinators, sterilizers, and power production and a feasibility study of solar house heating in Iran. The solar research at the Arya-Mehr University of Technology include the development of solar desalinators and inexpensive production of Cd-S solar cells. The solar research activities of the University of Tehran, College of Science and Technology, and the University of Azarabadegan are in their beginning stages and limited to the thermal applications of solar energy. Author (ESA)

N78-28529# National Research Centre, Cairo (Egypt).

ASPECTS OF SOLAR ENERGY RESEARCH IN EGYPT c44

I. A. Sakr *In* WMO Solar Energy 1977 p 328-341 (For primary document see N78-28501 19-42)

Avail: NTIS HC A99/MF A01

A series of investigations and studies utilizing the solar energy in different fields and including both engineering and economical evaluations were carried out. The program started with the thermal utilization of solar energy in different domains including solar water heating for domestic purposes, water desalination, refrigeration, cooking, and power generation. ESA

N78-28530# World Meteorological Organization, Geneva (Switzerland).

STATUS OF SOLAR ENERGY PROJECTS IN THE FEDERAL REPUBLIC OF GERMANY c44

F. J. Friedrich and H. Klein *In its* Solar Energy 1977 p 342-350 refs (For primary document see N78-28501 19-42)

Avail: NTIS HC A99/MF A01

In early 1974 the Federal Government initiated its Energy Research and Development Program for non-nuclear sources of energy aiming at reduction of dependence on oil imports and the long-term security of a wide range of energy supplies. Within this program solar energy research for both solar-thermal and photo-voltaic conversion is subsidized. In the field of solar-thermal conversion, a technological gap existed. Industry was first provided with the necessary funds to accumulate the required know-how. The second phase - which is now under way - is characterized by demonstration projects and preparation for quantity production processes. In a few years, complete solar hot water systems will be economically feasible. For the time being solar-electric conversion based on thermodynamic cycles is essentially cheaper than direct conversion by photovoltaic cells. Small solar power stations in the 10 kW level were to be available in 1977. Improved

production processes for silicon photo cells, as well as alternative material combinations, are under investigation, the aim being to achieve a substantial price reduction. Together with research on fuel production, these projects can have a significant economical impact by the end of the century. Author (ESA)

N78-28531# Pahlavi Univ., Shiraz (Iran). Solar Energy Center.

INTERNATIONAL COORDINATION AND PLANNING FOR A MORE EFFECTIVE UTILIZATION OF SOLAR ENERGY **c44**

Mehdi Nejad Bahadori *In* WMO Solar Energy 1977 p 351-356 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

Measures are suggested for global planning for more effective solar energy utilization including more efficient energy conversion or energy conservation. It is shown that by effective global planning it is possible to make better use of available energy resources and to improve the quality of the environment, thus using solar energy more effectively to meet the energy requirements of the world. ESA

N78-28532# State Univ. of New York, Albany.

SOLAR ENERGY DEVELOPMENT AND IMPLEMENTATION **c44**

Ronald Stewart and Volker A. Mohnen *In* WMO Solar Energy 1977 p 357-371 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

The Atmospheric Sciences Research Center and its professional staff received a special appropriation in 1974 from the Legislature of the State of New York to prepare options for the implementation of solar energy concepts. These included interaction with government, educational institutions and industry, research, development, and demonstration and position papers on energy policy. A statewide network for incoming solar radiation was established. Data analysis included hourly means and the monthly variation of hourly means, daily means and running means of three and five day periods, and monthly means with yearly variation of monthly means. Administrative results and research problems associated with the continued operation of the network are discussed. Projects for conversion of solar radiation for heating and cooling purposes are presented. Author (ESA)

N78-28533# World Meteorological Organization, Geneva (Switzerland).

SOLAR HOUSES: A GENERAL APPRAISAL OF SOLAR BUILDING DESIGN AND TECHNOLOGY **c44**

C. N. D. Stambolis *In its* Solar Energy 1977 p 372-414 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

An overall appraisal of solar heated and cooled buildings in the world today is given. A study, undertaken by the author on behalf of UNESCO, aimed at analyzing and comparing comprehensively, in terms of construction and performance, a number of successful solar buildings is presented. A brief historical introduction to the concept of using the sun's energy directly for heating buildings is made and the basic types of solar buildings are described and classified. Solar components and systems currently in use are discussed and the level of technological involvement present in the various types of solar building referred to is assessed. Selected examples of solar buildings are analyzed in terms of their location, construction, solar system, design and performance, and climatic adaption. Tables are presented comparing the above factors for various solar buildings and some conclusions are drawn as to the size of components used and the suitability of particular building designs for different climatic zones. The economics of solar building and the prospects which lie ahead for further research, development, and applications in this field are explored. Author (ESA)

N78-28534# Copenhagen Univ. (Denmark).

SOLAR HEAT SYSTEMS FOR USE AT HIGH LATITUDES **c44**

Bent Soerensen *In* WMO Solar Energy 1977 p 415-421 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

Factors such as the relative importance of the solar collector area, absorber efficiency, heat and reflection losses, concentrating collectors, and the nature and size of the storage facility of a solar heat system to be used in polar regions were investigated for various modes of operation. The economic justifications for adding the cost of a heat pump to the system are discussed. ESA

N78-28535# Genoa Univ. (Italy).

SOLAR ENERGY AND LIMITS TO THE ENERGY ON THE EARTH **c46**

G. Francia *In* WMO Solar Energy 1977 p 422-430 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

The consequences that man-produced energy might have on the planet's temperature were examined. It is shown that the production of energy on the earth's surface is considerably altering the thermal equilibrium at the earth surface and therefore modifying the climate in a dramatic way. The use of solar energy is recommended. ESA

N78-28536# Akademiya Nauk URSR, Kiev.

INFLUENCE OF SOLAR RADIATION AND RADIANT HEAT FLOW MEASUREMENT ERROR ON MEASUREMENT ACCURACY OF MATERIAL PHYSICAL CHARACTERISTICS IN SOLAR FURNACES **c44**

I. N. Frantsevitch, V. S. Dvernyakov, and V. V. Pasichny *In* WMO Solar Energy 1977 p 431-437 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

A solar furnace complex the Academy of Sciences of the Ukraine was used for the study of physical, mechanical, optical as well as some thermo-physical and physico-chemical properties of materials in temperature range from 180 C to 3500 K. The influence of solar radiation and heat flow measurement error at the focal spot on the physical properties are investigated. It is shown that based on an army searchlight with a 2 meter mirror, the measurement error of heat flows in the focal spot of a typical laboratory furnace is up to 15% to 20%. The calculation was carried out taking into account the guidance accuracy of the mirror, normal solar radiation measurements, the pattern position selected in relation to the focal spot, the accuracy of the calorimeter and measurement devices used, and other factors. In particular experimental data variability caused by the non-uniform structure of materials often surpass measurement errors. While studying material and coating radiative characteristics that undergo phase transformation over a given temperature range, the experimental data variability also surpasses measurement error because of the surface instability. Some considerations on ways of reducing measurement error and on the influence on accuracy of atmosphere phenomenon experiments that change the radiation spectrum but are not recorded by the usual laboratory actinometer AT-50. Author (ESA)

N78-28537# Centre National d'Etudes Spatiales, Toulouse (France).

INTEGRATION OF INFRA-RED AMBIENT TEMPERATURE AND WIND CONDITIONS IN FLAT COLLECTOR PERFORMANCE PREDICTION **c44**

R. Ployart, J. Colomes, and B. Devin *In* WMO Solar Energy 1977 p 438-449 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

The performance prediction of flat plate solar collectors is dependent on solar incidence angle, global radiation, and environmental conditions which determine the losses of the device. Extensive collector testing on solar simulator and curve fitting with physical models has shown the necessity to have infrared radiation collector performance at any location. Pyrradiometers can be used for infrared measurements, but it has been shown that a more simple method could be used at weather stations to derive a figure representative of ambient conditions for flat plate collectors. This is a stagnation temperature of a specific glass window which integrates the influence of infrared, wind, and ambient temperature. Justification and use of this environment equivalent temperature in collector performance is given and the measuring device described. Author (ESA)

N78-28538# Building Research Establishment, Watford (England).
SOLAR ENERGY APPLICATIONS IN UK BUILDINGS c44
R. G. Courtney *In* WMO Solar Energy 1977 p 450-458 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

Recent studies have shown that 40% to 50% of the UK energy consumption is used in buildings for heating, lighting, etc. Solar energy could assist in the provision of space and water heating and in the long term potentially cut energy consumption by 10% to 20%. The main characteristics of solar radiation in the UK are: (1) a high proportion (more than 50%) of diffuse radiation and (2) a large annual variation (10 : 1) in the energy received each month. These characteristics cause problems in the utilization of solar energy in buildings which are discussed. The economics of solar water heating - for which a small market exists in the UK - are briefly discussed and experimental projects in the use of solar energy for water and space heating purposes are described. These include a water heating system in a school and three houses which have installed 40 sq m of collector panels, 20 sq m of collector panels and 36 cu m of hot water storage, and a solar air heat and heat pump. The latter two houses are under construction. Prospects for the widespread use of solar energy in UK buildings are discussed. Author (ESA)

N78-28539# World Meteorological Organization, Geneva (Switzerland).
SOLAR HEATING PERFORMANCE EVALUATION c44
Dominique Roux, Bernard Tripod, and Jean Robert Mueller *In its* Solar Energy 1977 p 459-468 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

A basic question to the application of solar energy for building heating is a quantitative evaluation of the available useful energy for heating, taking into account a given solar collector system in the prevailing meteorological conditions. Commonly, this problem is handled with static considerations (average number of Langley per day, mean collector efficiency, etc.) and the importance of heat losses is only guessed. To overcome this situation, a solar water heating installation (near Geneva), designed with a hot water storage tank to perform dynamic and global measurements was extensively instrumented. The dynamic measurements yield heat losses evaluation as a function of the solar radiation received during successive days with variable weather conditions. In addition global measurement of the energy available for use is correlated with the monthly meteorological data provided by the Airport of Geneva. This approach has the main advantage to complete a precise analytical performance evaluation of solar heating systems. The evaluation consists in establishing a dynamic model including all the system components and in comparing it with experimental data. Method and results can be used for evaluation of systems operating in different meteorological conditions. The method and the results are presented. Author (ESA)

N78-28540# World Meteorological Organization, Geneva (Switzerland).
SOLAR ENERGY FOR COOLING: A CHALLENGE TO MODERN TECHNOLOGY c44
Clifford C. O. Ezeilo *In its* Solar Energy 1977 p 469-478 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

Maximum demand for comfort cooling and refrigeration occurs in hot climates particularly the tropics. High humidity and cloudiness hamper solar insolation in such regions yet the relatively long all-year-round hours of free and clean sunshine make solar refrigeration an attractive proposition. Experiments in which a flat plate collector and a paraboloidal cylindrical concentrator are used for the solar energy harvest are described. Water is the energy absorbing fluid and the heated water is circulated by regulated thermosyphon action to a lagged collector enclosing the generator of type 27A1 production no. 9280271 - domestic Electrolux absorption refrigeration unit. Thermal energy from the sun then replaces the kerosene burning process in such systems. Water/ammonia is the primary generator binary mixture and results obtained show that with collector areas of close to 2.0 sq m, the maximum generator temperature is aboout 80 C and the maximum cooling in the evaporator only about 14 C below the ambient temperature of around 33 C. The conventional water/ammonia system is therefore not the best suitable for solar refrigeration. Lithium-Bromide/water systems and others that abound in solar energy literature may well be attractive propositions; yet a solar powered cooling system that relies on no auxiliary power source and yet produces large enough refrigerating effect (even for domestic use) is still a challenge. Author (ESA)

N78-28541# World Meteorological Organization, Geneva (Switzerland).
THE ROLE OF SOLAR ENERGY IN SOLAR HEATING, COOLING AND HOT WATER SUPPLY c44
Tetsuo Noguchi *In its* Solar Energy 1977 p 479-485 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

In recent years, world-wide attention has been focused on solar heating, cooling, and hot water supply for residential houses, schools, and commercial buildings both for experimental and demonstration purposes. The guidelines for these projects are based on energy conservation and research and development on alternative sources of energy especially directed to solar energy. Multinational as well as bilateral cooperation on research and development of solar heating and cooling buildings has been announced and is in progress; more than 100 demonstration solar houses will be constructed by the end of the 1976 fiscal year throughout the world. In addition to the development of solar water heaters and solar heating, recent technologies have verified the use of LiBr-water absorption units with a flat plate collector for solar cooling. This technology is being developed with a view to establishment of a commercial market for solar space heating and cooling in about 1980-1985. System analysis, systems components studies such as on solar collectors, heat storage and air conditioning units, testing and standardization of solar heating and cooling systems will be greatly promoted through international cooperation. Integrated research and development on these technologies which are of the most importance might contribute to the development of solar drying, irrigation water pumping, green houses, desalination, and other low temperature solar heat processes which will support the development of solar energy industries for developing countries. Author (ESA)

N78-28542# World Meteorological Organization, Geneva (Switzerland).
THE APPROPRIATENESS AND IMPLEMENTATION OF SOLAR ENERGY IN RURAL DEVELOPMENT PROGRAMMES OF DEVELOPING COUNTRIES c44
W. K. Kennedy *In its* Solar Energy 1977 p 486-497 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

An evaluation of the contribution which solar energy can make to the rural development efforts of developing countries was carried out. In particular the priorities of solar energy implementation geared to specific objectives within rural development programs are outlined. The difficulties incurred are considered and the strategy and further development necessary to promote the implementation of solar energy in rural areas are specified. Author (ESA)

N78-28543# World Meteorological Organization, Geneva (Switzerland).
DESIGN AND ECONOMY OF SOLAR POWER PLANTS WITH INTEGRATED THERMAL ENERGY STORAGE c44
P. V. Gilli and G. Beckmann *In its* Solar Energy 1977 p 498-506 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

Due to discrepancies of electric supply and demand patterns in solar steam power plants, energy storage - either integrated thermal energy storage (before generator), pumped hydro storage (after generator, before meter), or storage at the customer (after meter) - is required. Steam storage requires pressure vessels and is limited in temperature, but oil or fused salt are more expensive and require heat transfer equipment - and a temperature differential - for charging and discharging. It is claimed that the new technology of the Prestressed Cast Iron Pressure Vessel (PCIV) has shifted the economic balance in favor of steam storage, because, due to the character of the PCIV cost function, higher

pressures have become economically interesting and much larger units (of, for instance, 8000 cu m at a pressure of 60 bar) can be built. The PCIV leads to the development of new flow sheets for the integration of the thermal storage system into the plant. PCIV steam accumulators of the pressure-drop type and of the new expansion-type with flash evaporators are investigated. There is also a limited possibility for utilizing feed water storage. Cost data presented show that integrated steam storage by means of PCIV of the types considered is an attractive possibility for balancing electric supply and demand and thus for maximum utilization of insolation in solar steam power plants.

Author (ESA)

N78-28544# Rome Univ. (Italy).
SOLAR DESALINATION: STATUS AND POTENTIAL **c44**
Carlo Mustacchi and Vincenzo Cena *In* WMO Solar Energy 1977 p 507-518 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

Freshwater can be produced by means of solar energy at a cost of 1 to 1.7 $/cu m with a margin of the order of 5% towards fossil-fired operation. This concerns plants having a nominal production of at least 50 cu m/hr and the multistage flash evaporator concept. For much smaller capacities, basin stills, at a cost of 2 $/cu m, are a convenient low-technology solution. These margins will increase to 30% within the next ten years, and can even lead to better prospects provided that priority is given to the present bottlenecks of this technology; namely, increasing lifetime and reliability, designing an appropriate heat storage system, improving the dynamics of startup and shutdown for the plants. Author (ESA)

N78-28545 Centre National d'Etudes Spatiales, Paris (France).
SOLAR ELECTRICITY **c44**
W. Palz *In* WMO Solar Energy 1977 p 519-538 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

The possibility of direct solar energy to displace part of the conventional fossil prime energy which serves to generate the remainder of the electricity is emphasized. Potential conversion processes for solar electricity generation are reviewed, including solar cells and mechanical conversion by engines. Photovoltaic solar generator performance is discussed. It is concluded that current and future development programs on solar electricity should be planned as an integrated effort on various related problems, particularly in the areas of energy storage and meteorological data collection. ESA

N78-28546# College of Petroleum and Minerals, Dhahran (Saudi Arabia).
DIRECT CONVERSION OF SOLAR ENERGY INTO ELECTRICITY **c44**
M. Ali Kettani *In* WMO Solar Energy 1977 p 539-549 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

Possibilities of conversion of solar energy into electricity are considered namely: direct conversion, conversion through heat stage, conversion through a mechanical stage, and through a chemical stage. Four methods are discussed: the photovoltaic conversion, photoemissive conversion, photogalvanic conversion, and photomagnetic conversion. A material surface could absorb as much as 95 percent of solar energy and convert it into heat. The difference between input heat and the rejected heat could be converted into electricity directly or indirectly. In the direct case thermo-electricity and thermionic processes are used. In the indirect case, heat engines and regenerative fuel cells can be considered. Solar energy can first be converted into mechanical or hydraulical energy before being converted into electricity. It can also be converted into chemical or biological energy or any other form. These different possibilities are analyzed and their potentialities discussed. Author (ESA)

N78-28547# Royal Aircraft Establishment, Farnborough (England).
PERFORMANCE RATING OF PHOTOVOLTAIC SOLAR GENERATORS FOR TERRESTRIAL APPLICATIONS **c44**
F. C. Treble *In* WMO Solar Energy 1977 p 550-560 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

The performance of photovoltaic solar generators is commonly expressed in terms of peak power. By this is meant the power which the generator would deliver at the nominal working voltage and a particular temperature when illuminated by sunlight at an intensity of 1000 W/sq m. As it stands, this terminology is imprecise, mainly because the output at a given intensity is significantly influenced by the spectral energy distribution of the sunlight, which varies with location, weather, time of year and time of day. Differences in test procedure and equipment can also give rise to discrepancies. A need has, therefore, arisen for international agreement on a standard sun and standard procedures and equipment for performance testing. The various operations are reviewed and discussed. Recommendations are made for an international code of practice, stipulating the use of standard solar cells calibrated by a recognized agency for monitoring the intensity of illumination during performance tests and relating it to standard sunlight. The recommendations cover the selection and calibration of standard cells, performance test procedures, solar simulators, temperature control and instrumentation. Author (ESA)

N78-28548 World Meteorological Organization, Geneva (Switzerland).
PHOTOVOLTAIC CONVERSION OF CONCENTRATED SOLAR RADIATION **c44**
K. Krebs and E. Gianoli *In its* Solar Energy 1977 p 561-569 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

Since one of the main difficulties which prevent a large scale utilization of solar electricity is caused by the low energy density of the incident solar radiation, the basic problem of obtaining a low cost vs. energy output ratio could be solved by: development of low cost solar cells, concentration of incident radiation, or by a combination of both. The development of low cost solar cells alone is at the limit of technological possibilities, thus some concentration might always be needed to make those additional savings necessary to reach the break-even point for solar electricity. Necessary conditions to make this concept viable, namely (1) the quality of incident radiation, (2) the behavior of solar cells under high intensity with indication for possible improvements, and (3) the limits and possibilities of simple concentrator systems are discussed. Some experimental results are discussed. Author (ESA)

N78-28549# World Meteorological Organization, Geneva (Switzerland).
STATUS REPORT ON THE DEVELOPMENT OF TERRESTRIAL SOLAR GENERATORS **c44**
E. F. Schmidt *In its* Solar Energy 1977 p 570-580 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

The goal of utilization of solar energy as a competitive power source to cover considerable portions of power demand can only be met if the cost expenditure for solar-electric devices is kept to a minimum. When designing power supply systems, the following sub-system areas have to be considered: (1) development of low cost Si-base material; (2) development of technologies for manufacturing solar cells from different new types of base material; (3) development of low-cost generator modules by integrating solar cells mechanically and electrically; and (4) development and/or stimulation of development of electronic power conditioning and energy storage sub-systems. The market for terrestrial solar generators is surveyed. To study long-term environmental effects a solar generator of 1 kW is being manufactured and a test program is being carried out. The planned activities in development of terrestrial solar generators at AEG-Telefunken within the next decade are surveyed.

Author (ESA)

N78-28550# World Meteorological Organization, Geneva (Switzerland).
PROSPECTS OF POWER GENERATION FROM SOLAR PLANTS IN THE NORTH EAST OF BRAZIL **c44**
L. S. Cheema, Cleantho daCamaraTorres, and Pio Caetano Lobo *In its* Solar Energy 1977 p 581-590 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

The prospects for the utilization of solar power plants in the north east of Brazil, are studied for small communities removed from the power grid. The number of units that would be economically feasible depends on the price of plant per unit of installed capacity and the possibility of energy storage and subsidiary functions (distillation, pumping) performed by the plant. Some solutions that may reduce the cost of plant and price targets that appear to be viable in the near future are considered. The most interesting applications of solar power plant lie in the low capacity range (up to 10 kW). This position derives from the fact that solar power cost per unit installed capacity is practically independent of unit size. Whereas in conventional plants the economics of scale apply, i.e. cost per unit, installed capacity falls as the capacity of the plant increases. Based on the electricity power grid in the north east of Brazil, the maximum demand for small solar power plants given two different selling prices per unit of installed capacity is estimated. Areas in the north east of Brazil where the installation of solar power plants is considered possible are indicated. Author (ESA)

N78-28551# World Meteorological Organization, Geneva (Switzerland).

A CRITICAL STUDY OF THE PHOTOELECTRIC CELL PREPARATION TECHNIQUES **c44**

J. Dixmier, M. Rodot, and M. Barbe *In its* Solar Energy 1977 p 591-599 ref (For primary document see N78-28501 19-42)
Avail: NTIS' HC A99/MF A01

A comparative study of the various techniques used in the preparation of monocrystalline and polycrystalline materials for photoelectric cells is presented. Evaporation, C.V.D. spray, electro and chemical deposition techniques are reviewed and compared introducing criteria such as thermodynamic cost, cristallographic and electric quality of them as prepared materials, industrial production ability, etc. Such a study provides guidelines for laboratories and industries interested in photovoltaic cells. The choice of the semiconducting materials themselves is guided by a discussion of some specific optical and electrical properties. Selection criteria are presented for these materials, showing that Si, Cu2S, CdTe and GaAs are the best candidates. The applicability of the above-mentioned preparation techniques to these materials is discussed. Author (ESA)

N78-28552# World Meteorological Organization, Geneva (Switzerland).

SMALL SCALE ELECTRIC POWER GENERATION BY MEANS OF A STATIONARY SPHERICAL REFLECTOR/TRACKING ABSORBER (SRTA) SOLAR COLLECTOR SYSTEM IN DEVELOPING COUNTRIES **c44**

F. Kreigh and J. F. Kreider *In its* Solar Energy 1977 p 600-610 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

The possibility of using large scale Spherical Reflector/Tracking Absorber (SRTA) solar collectors for generating electrical power in various parts of the world is investigated, with particular emphasis on developing countries. Large SRTA reflectors can be built with medium technology by using an approach similar to that employed in the construction of the 305 meter-diameter Arecibo Observatory in Puerto Rico. To test the proposed concept, an eight foot model of a stationary SRTA solar collector was built and the efficiency of the collector absorber system was determined experimentally at the NASA Goddard Space Flight Center. The collector is described, the experimentally measured thermal performance is compared with analytical predictions based on a simplified model and the experimental results of the scale model are extrapolated to the performance of a 10 and a 100 megawatt solar electrical power generation system. Several methods of construction for the large scale unit are proposed and possible combinations of the solar power plant with an oil or coal fired backup and a hydroelectric power station are described. Finally, estimates of the cost of solar electric power derived from an SRTA solar steam generator are presented for various parts of the world, based on available solar insolation data. Author (ESA)

N78-28553# World Meteorological Organization, Geneva (Switzerland).

REALIZATION AND TESTING OF A PUMPING SYSTEM POWERED BY SOLAR CELLS **c44**

D. Campana, A. Castiel, A. Perez, J. A. Roger, C. Dupuy, P. Lavit, and M. Lepert *In its* Solar Energy 1977 p 611-620 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

The possibilities for powering isolated pumping systems by solar energy are studied. Such systems would be suitable, for example, for providing water to remote farms or high-mountainsheep folds, for irrigation of these remote lands, and in general should be of interest in regions where electrical power transmission or transport of fuel oil is difficult or too expensive. Moreover, application in developed countries could avert pollution where it is a recognized problem. The study is based on an average farm in Corsica and includes the following aspects: determination of the solar flux at the earth's surface based on meteorological data (statistics during four year) and the design of panels; determination of the mounting of the panels (total surface area, orientation, grouping, etc.); choice of a direct-current motor and pump to be operated directly by the panels according to the requirements of the well; tests of the assembly as a function of orientation of the panels; and comparisons with theoretical models. Various possibilities for improving the system are discussed. Author (ESA)

N78-28554# World Meteorological Organization, Geneva (Switzerland).

THE THERMODYNAMICS OF SOLAR ENERGY CONVERSION **c44**

Gerd Blaesser *In its* Solar Energy 1977 p 622-630 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

A unified thermodynamical description of converting systems for the utilization of solar energy is given. It is shown that the free energy function can be written approximately as the sum of two terms., of which the first, the spectral term, depends on the matching of the converter to the sun's spectrum, while the second, the concentration term, contains the effects of the concentration of the radiation by means of mirrors, etc. Theoretical (thermodynamical) efficiencies for some typical systems are derived within the frame of this general formalism and discussed as examples. Author (ESA)

N78-28555# Wien Univ. (Austria).

PHOTOCHEMICAL HYDROGEN PRODUCTION THROUGH SOLAR RADIATION BY MEANS OF THE MEMBRANE PRINCIPLE **c44**

E. Broda *In* WMO Solar Energy 1977 p 631-637 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

Nuclear experts are considering a hydrogen economy where H2 serves as a fuel to make electricity, as a chemical reactant, as a metallurgical reductant and as a source of food. Now H2 could also be made by photolysis of water. Theoretically, a quantum of green light carries enough energy for the reaction $H2O = H2 + 1/2O2$. With long-wave light, photolysis could be achieved by combination of 2 quanta. Yet attempts to photolyze water, in presence of sensitizers (photocatalusts), have failed. In the last analysis, this is due to re-combination of the primary, highly reactive, products of the photochemical reaction. A solution of the problem is to be found by the spatial separation of the primary products, i.e. by development of suitable membranes where these products, and therefore also the stable gases H2 and O2 come out on opposite sides. The feasibility of this membrane principle has been shown in Nature for 3 giga-years. Using membranes, all photosynthetic cells (photosynthetic bacteria and plants) succeed in the photo-production of a reductant (in many cases at least ferredoxin in the reduced form) with a redox potential equal to that of H2 in neutral solution (-0.4 V). The reductant can, but need not, be used by the cells for CO2 assimilation. In man-made technology, the reducing power would be diverted as H2. It is not suggested to use or copy living cells. Rather their operation is to be studied so that technically useful membranes for water photolysis can be constructed abiotically. The scientific and practical aspects of large-scale photolytic H2 production are discussed. Author (ESA)

N78-28556# World Meteorological Organization, Geneva (Switzerland).

INVESTIGATIONS ON SEMICONDUCTOR/ELECTROLYTE

SOLAR CELLS AND THE QUESTION OF THE PHOTO-ASSISTED WATER DECOMPOSITION c44
W. Gissler *In its* Solar Energy 1977 p 638-647 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

The photovoltaic effect at semiconductor/electrolyte interfaces can be exploited for the construction of solar cells. Possible advantages and problems of such solar cells are discussed. The cells can work in a self regenerative mode of operation converting solar energy in electrical energy, and/or they can convert solar energy in chemical energy decomposing the electrolyte or compounds dissolved in it. Most attractive is the photo assisted water decomposition, the conditions for which will be discussed. To demonstrate the feasibility, cells with different semiconductor/electrolyte combinations have been constructed and tested. In spite of simple electrode preparation techniques and the use of polycrystalline material large quantum efficiencies could be obtained (85% for the cell TiO2/0.1 m Na2SO4/Pt). Losses during the charge transfer can lead to a considerable reduction of the expected energy efficiency. Water decomposition could not be effected even with large band gap semiconductors and at high light intensities, because the obtained cell voltages were smaller than the water decomposition voltage. Applying to the solar cell the missing voltage photoassisted electrolysis could be performed. This process might be more effective than the self regenerative mode of operation. Author (ESA)

N78-28557# World Meteorological Organization, Geneva (Switzerland).
THE QUANTITATIVE EVALUATION OF WOOD AS A SOURCE OF SOLAR ENERGY c44
Waldo E. Smith *In its* Solar Energy 1977 p 648-654 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

The waste wood from U.S. forest harvests is substantial, and in the face of the rapid depletion of the world's fossil fuels, should be developed as a renewable energy source. Also consideration should be given to the development of energy farms on which plants of high energy production can be grown as an annual or periodic crop on lands now largely lying idle. It would appear that by intensive endeavor the energy equivalent of two or three percent of current petroleum use within five years, and over a longer period, these sources may have the energy equivalence of 25 to 30 percent of US current petroleum usage. The sources considered are as follows: (1) trimmings in the conversion of logs to lumber and timber for use; (2) small trees and branches, twigs, etc.; (3) use of wastes from paper pulp production; (4) improvements in forest management, including genetic control; and development of energy farms.
Author (ESA)

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N78-28558 State Univ. of New York, Buffalo.
A PHOTOGRAPHIC REMOTE SENSING SYSTEM FOR THE DETECTION AND QUANTIFICATION OF URBAN TREE STRESS Ph.D. Thesis
Bov Bang Eav 1977 207 p
Avail: Univ. Microfilms Order No. 78-06180

A statistical model was developed to permit quantitative prediction of urban tree stress levels based on spot microdensitometric measurements. Multidate, large scale, 70 mm color and color infrared photography was acquired simultaneously with ground data for 1156 maple trees at four study sites in Syracuse, New York. Results indicated that: (1) broad band microdensitometric data extracted from color infrared photography can be used in some cases to previsually detect the presence of urban tree stress, (2) the multiple regression model developed permitted accurate prediction of quantitative tree stress indices for drought-induced stress, (3) an index expressing tree foliage symptoms was most accurately predicted from the aerial photographic data, (4) color infrared film proved to be superior to normal color film in predicting tree stress symptoms, (5) multiple stress symptom parameters measured on the ground can be combined into a small number of composite stress indices through factor analysis, and, (6) the timing of aerial photography with respect to rainfall and development of stress manifestation accrued on the ability of aerial data to predict drought-related stress.
Dissert. Abstr.

N78-28559 Minnesota Univ., Minneapolis.
LANDSAT DIGITAL DATA APPLICATION TO FOREST VEGETATION AND LAND-USE CLASSIFICATION IN MINNESOTA Ph.D. Thesis
Roy Alan Mead 1977 112 p
Avail: Univ. Microfilms Order No. 78-09702

Three methods of accuracy verification were applied to eleven land cover categories mapped from LANDSAT data. As a result, it was quite apparent that the accuracy of mapping land cover on large blocks of land, including transition zones and vegetation type mixtures, gave lower estimates of accuracy than was realized on either training sets or test sets. Evaluation of the various map solutions by experienced field resource management cooperators resulted in the judgment that the classification accuracies were so low as to preclude practical use for their purposes at this time. Dissert. Abstr.

N78-28560*+ National Aeronautics and Space Administration, Washington, D. C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 17
Apr. 1978 187 p
(NASA-SP-7041(17)) Avail: NTIS HC E05 CSCL 05B

This bibliography lists 775 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1 and March 31, 1978. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. Author

N78-28561 Miami Univ., Fla.
THE HYDRO-THERMAL CHARACTERISTICS OF SHALLOW LAKES Ph.D. Thesis
Cecil Vance Carter 1977 259 p
Avail: Univ. Microfilms Order No. 7808236

A three-dimensional mathematical model was developed which is specialized for the study of the hydrodynamics of shallow lakes. The model consists of a set of nonlinear partial difference equations which are solved by a high speed digital computer. The hydrodynamics model includes the nonlinear inertia terms but omits the horizontal diffusion items. The model allows the fluid surface to displace in response to wind shear, pressure gradients, and Coriolis accelerations. The thermal dynamics model includes the nonlinear convection terms but omits horizontal diffusion. A new solar heating model is used which includes the effects of cloud cover and the sun's elevation angle. A detailed heat balance is made at the air-water interface. The partial difference equations are written in the central-space, central-time format. The Du Fort-Frankel method is used. Dissert. Abstr.

N78-28562 Colorado School of Mines, Golden.
THE EVALUATION OF OIL FOAM FOR USE AS A DISPLACING MEDIUM FOR OIL RECOVERY IN POROUS MEDIA Ph.D. Thesis
Hazim Hassan Al-Attar 1976 143 p
Avail: Univ. Microfilms Order No. 78-02792

The displacement of oil by externally generated foam was tested for three foam qualities under 15 psi imposed pressure differential. Test results showed that oil recoveries observed by oil foam displacement were appreciably higher than those observed by gas drive. Gravity effects increased oil recovery by as much as 19 percent over the horizontal test. The plastic viscosity of oil foam was measured for three foam quality ranges using a capillary tube. Foam viscosity was found to increase as the quality

increased. Oil foams expressed non-Newtonian behaviors but low values of yield stress. The existence of foam in the flow tests was determined by gas breakthrough time, relative permeability calculations and theoretically by capillary tube representation of the porous medium. The theoretical results matched the experimental results when oil foam displaced oil and when oil displaced water. However, the results showed a discrepancy when gas displaced oil. Dissert. Abstr.

N78-28563*# Academy of Scientific Research and Technology, Cairo (Egypt).
GEOLOGY OF KHARGA-DAKHLA OASES AREA, WESTERN DESERT, EGYPT, FROM LANDSAT-1 SATELLITE IMAGES
E. M. ElShazly, M. A. Abdel-Hady, I. A. ElKassas, A. B. Salman, H. ElAmin, M. M. ElShazly, and A. A. AbdelMegid, Principal Investigators Apr. 1976 63 p refs Sponsored by NASA Original contains color illustrations ERTS
(E78-10158; NASA-CR-157276) Avail: NTIS HC A04/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N78-28564*# Academy of Scientific Research and Technology, Cairo (Egypt).
GEOLOGIC INTERPRETATION OF LANDSAT SATELLITE IMAGES FOR THE QATTARA DEPRESSION AREA, EGYPT
E. M. ElShazly, M. A. Abdel-Hady, M. A. ElGhawaby, S. M. Khawasik, and M. M. ElShazly, Principal Investigators Nov. 1976 100 p refs Sponsored by NASA Original contains color illustrations ERTS
(E78-10159; NASA-CR-157277) Avail: NTIS HC A05/MF A01 CSCL 08G
The author has identified the following significant results. For the first time the regional geological units are given. Faults, fractures, and folds are included, as well as drainage lines which help to visualize the environmental impact of the Qattara project for electric power generation and to assess the regional questions involved in its implementation.

N78-28565*# Academy of Scientific Research and Technology, Cairo (Egypt).
SATELLITE MAPPING: REGIONAL GEOLOGY, GEOMORPHOLOGY, STRUCTURE, DRAINAGE AND HYDROLOGY OF BAHR EL JEBEL AREA, JONGLEI CANAL PROJECT AREA, SOUTHERN SUDAN
E. M. ElShazly, M. A. Abdel-Hady, M. A. ElGhawaby, A. B. Salman, I. A. ElKassas, S. M. Khawasik, M. M. Elrakaiby, H. ElAmin, M. M. ElShazly, and W. Iskandar, Principal Investigators Apr. 1978 229 p refs Sponsored by NASA Original contains color illustrations ERTS
(E78-10160; NASA-CR-157278) Avail: NTIS HC A11/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N78-28566*# Academy of Scientific Research and Technology, Cairo (Egypt).
SOIL RESOURCES AND POTENTIAL FOR AGRICULTURAL DEVELOPMENT IN BAHR EL JEBEL IN SOUTHERN SUDAN, JONGLEI CANAL PROJECT AREA
Victor I. Myers, Donald G. Moore, M. A. Abdel-Hady, A. G. Abdel-Samie, E. M. ElShazly, Principal Investigators, Hussein Youvis, B. K. Worcester, A. A. Klingebiel, M. M. ElShazly, M. A. Hamad et al Apr. 1978 189 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E78-10161; NASA-CR-157279) Avail: NTIS HC A09/MF A01 CSCL 02C
The author has identified the following significant results. Fourteen LANDSAT scenes were used to produce mosaics of the 167, 474 sq km study area. These were black and white MSS 7 images and false color composite images. Five major soil-landscape units were delineated on the mosaics, and these were subdivided into a total of 40 soil mapping units. Aerial reconnaissance was useful in defining boundaries between mapping units and in estimating the proportion of the various soils which composed each mapping unit. Ground surveying permitted first-hand observation of major soils and sampling for quantitative laboratory analysis. Soil interpretations were made, including properties, potentials, and limitations.

N78-28567*# Academy of Scientific Research and Technology, Cairo (Egypt).
GEOLOGICAL AND ENVIRONMENTAL RESOURCES INVESTIGATIONS IN EGYPT USING LANDSAT IMAGES
Final Progress Report
M. A. Abdel-Hady, Principal Investigator [1978] 6 p Sponsored by NASA ERTS
(E78-10162; NASA-CR-157280) Avail: NTIS HC A02/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N78-28568*# Academy of Scientific Research and Technology, Cairo (Egypt).
GEOLOGICAL AND ENVIRONMENTAL RESOURCES INVESTIGATIONS IN EGYPT USING LANDSAT IMAGES
Quarterly Progress Report
M. A. Abdel-Hady, Principal Investigator [1978] 14 p Sponsored by NASA ERTS
(E78-10163; NASA-CR-157281; QPR-1) Avail: NTIS HC A02/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N78-28569*# Academy of Scientific Research and Technology, Cairo (Egypt).
GEOLOGICAL AND ENVIRONMENTAL RESOURCES INVESTIGATIONS IN EGYPT USING LANDSAT IMAGES
Quarterly Progress Report
M. A. Abdel-Hady, Principal Investigator [1978] 17 p refs Sponsored by NASA ERTS
(E78-10164; NASA-CR-157282; QPR-2) Avail: NTIS HC A02/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N78-28570*# Academy of Scientific Research and Technology, Cairo (Egypt).
GROUNDWATER STUDIES IN ARID AREAS IN EGYPT USING LANDSAT SATELLITE IMAGES
E. M. ElShazly, M. A. Abdel-Hady, and M. M. ElShazly, Principal Investigators 1977 10 p refs Presented at 11th Intern. Symp. on Remote Sensing of Environment, Michigan, 25-29 Apr. 1977 Sponsored by NASA ERTS
(E78-10165; NASA-CR-157283) Avail: NTIS HC A02/MF A01 CSCL 08H
There are no author-identified significant results in this report.

N78-28571*# Academy of Scientific Research and Technology, Cairo (Egypt).
APPLICATION OF LANDSAT IMAGERY IN THE GEOLOGICAL AND SOIL INVESTIGATIONS IN THE CONTROL WESTERN DESERT, EGYPT
E. M. ElShazly, M. A. Abdel-Hady, M. M. ElShazly, M. A. ElGhawaby, S. M. Khawasik, A. A. Haraga, S. Sanad, and S. H. Attia, Principal Investigators 1978 10 p refs Presented at 12th Intern. Symp. on Remote Sensing of the Environment, Manila, Philippines, 20-26 Apr. 1978 Sponsored by NASA ERTS
(E78-10166; NASA-CR-157284) Avail: NTIS HC A02/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N78-28572*# Academy of Scientific Research and Technology, Cairo (Egypt).
APPLICATION OF LANDSAT SATELLITE IMAGERY FOR IRON ORE PROSPECTING IN THE WESTERN DESERT OF EGYPT
E. M. ElShazly, M. A. Abdel-Hady, M. A. ElGhawaby, and S. M. Khawasik, Principal Investigators 1977 12 p refs Presented at 11th Intern. Symp. on Remote Sensing of Environment, Michigan, 25-29 Apr. 1977 Sponsored by NASA ERTS
(E78-10167; NASA-CR-157285) Avail: NTIS HC A02/MF A01 CSCL 08G

The author has identified the following significant results. The delineation of the geological units and geological structures through image interpretation, corroborated by field observations and structural analysis, led to the discovery of new iron ore deposits. A new locality for iron ore deposition, namely Gebel Qalamun, was discovered, as well as new occurrences within the already known iron ore region of Bahariya Oasis.

N78-28573*# Academy of Scientific Research and Technology, Cairo (Egypt).
LANDSAT SATELLITE MAPPING IN EGYPT AND ITS POSSIBLE APPLICATIONS IN PETROLEUM AND NATURAL GAS EXPLORATION
E. M. ElShazly and M. A. Abdel-Hady, Principal Investigators 1977 19 p refs Presented at 10th Arab Petroleum Congr., Tripoli, 19-25 Dec. 1977 Sponsored by NASA ERTS
(E78-10168; NASA-CR-157286) Avail: NTIS HC A02/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N78-28574*# Academy of Scientific Research and Technology, Cairo (Egypt).
REGIONAL PROSPECTING FOR IRON ORES IN BAHARIYA OASIS-EL FAIYUM AREA, EGYPT, USING LANDSAT-1 SATELLITE IMAGES
E. M. ElShazly, M. A. Abdel-Hady, M. A. ElGhawaby, and S. M. Khawasik, Principal Investigators Feb. 1976 63 p refs Sponsored by NASA Original contains color illustrations ERTS
(E78-10169; NASA-CR-157287) Avail: NTIS HC A04/MF A01 CSCL 08G
The author has identified the following significant results. New discoveries of iron deposits were registered as a result of the LANDSAT imagery, and the conditions of the already known iron deposits and occurrences were regionally connected and verified.

N78-28575*# Academy of Scientific Research and Technology, Cairo (Egypt).
GEOLOGICAL AND GROUNDWATER POTENTIAL STUDIES OF EL ISMAILIYA MASTER PLAN STUDY AREA
E. M. ElShazly, M. A. Abdel-Hady, M. M. ElShazly, M. A. ElGhawaby, I. A. ElKassas, A. B. Salman, and M. A. Morsi, Principal Investigators Apr. 1975 58 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E78-10170; NASA-CR-157288) Avail: NTIS HC A04/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N78-28576*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
A PARAMETRIC MULTICLASS BAYES ERROR ESTIMATOR FOR THE MULTISPECTRAL SCANNER SPATIAL MODEL PERFORMANCE EVALUATION
B. G. Mobasseri, C. D. McGillem, and P. E. Anuta, Principal Investigators 1978 294 p refs EREP
(Contracts NAS9-14016; NAS9-14970; NAS9-15466)
(E78-10171; NASA-CR-151745; LARS-TR-061578; TR-EE-78-22) Avail: NTIS HC A13/MF A01 CSCL 05B
The author has identified the following significant results. The probability of correct classification of various populations in data was defined as the primary performance index. The multispectral data being of multiclass nature as well, required a Bayes error estimation procedure that was dependent on a set of class statistics alone. The classification error was expressed in terms of an N dimensional integral, where N was the dimensionality of the feature space. The multispectral scanner spatial model was represented by a linear shift, invariant multiple, port system where the N spectral bands comprised the input processes. The scanner characteristic function, the relationship governing the transformation of the input spatial, and hence, spectral correlation matrices through the systems, was developed.

N78-28577*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
ECHO USER'S GUIDE
D. A. Landgrebe, Principal Investigator, James L. Kast, Philip H. Swain, Barbara J. Davis, and Paul W. Spencer Aug. 1977 79 p refs EREP
(Contract NAS9-14970)
(E78-10172; NASA-CR-157289; LARS-Publ-083077) Avail: NTIS HC A05/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N78-28578*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
FOREST RESOURCE INFORMATION SYSTEM Quarterly Report, 1 Jan. - 31 Mar. 1978
R. P. Mroczynski, Principal Investigator 20 Mar. 1978 40 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-15325)
(E78-10173; NASA-CR-151737) Avail: NTIS HC A03/MF A01 CSCL 02F
There are no author-identified significant results in this report.

N78-28579*# Ocean Data Systems, Inc., Monterey, Calif.
ATMOSPHERIC MODEL DEVELOPMENT IN SUPPORT OF SEASAT. VOLUME 1: SUMMARY OF FINDINGS Final Technical Report
Philip G. Kesel 30 Sep. 1977 303 p Prepared for JPL 5 Vol.
(Contracts NAS7-100; JPL-954668)
(NASA-CR-157327) Avail: NTIS HC A14/MF A01 CSCL 22A
Atmospheric analysis and prediction models of varying (grid) resolution were developed. The models were tested using real observational data for the purpose of assessing the impact of grid resolution on short range numerical weather prediction. The discretionary model procedures were examined so that the computational viability of SEASAT data might be enhanced during the conduct of (future) sensitivity tests. The analysis effort covers: (1) examining the procedures for allowing data to influence the analysis; (2) examining the effects of varying the weights in the analysis procedure; (3) testing and implementing procedures for solving the minimization equation in an optimal way; (4) describing the impact of grid resolution on analysis; and (5) devising and implementing numerous practical solutions to analysis problems, generally. G.Y.

N78-28580*# Ocean Data Systems, Inc., Monterey, Calif.
ATMOSPHERIC MODEL DEVELOPMENT IN SUPPORT OF SEASAT. VOLUME 2: ANALYSIS MODELS Final Technical Report
Rodger A. Langland 30 Sep. 1977 153 p refs Prepared for JPL 5 Vol.
(Contracts NAS7-100; JPL-954668)
(NASA-CR-57328) Avail: NTIS HC A08/MF A01 CSCL 22A
As part of the SEASAT program of NASA, two sets of analysis programs were developed for the Jet Propulsion Laboratory. One set of programs produce 63 x 63 horizontal mesh analyses on a polar stereographic grid. The other set produces 187 x 187 third mesh analyses. The parameters analyzed include sea surface temperature, sea level pressure and twelve levels of upper air temperature, height and wind analyses. The analysis output is used to initialize the primitive equation forecast models. G.Y.

N78-28581*# Ocean Pata Systems, Inc., Monterey, Calif.
ATMOSPHERIC MODEL DEVELOPMENT IN SUPPORT OF SEASAT. VOLUME 3: PREDICTION MODELS Final Technical Report
Robert E. Wellck 30 Sep. 1977 165 p refs Prepared for JPL 5 Vol.
(Contracts NAS7-100; JPL-954668)
(NASA-CR-157329) Avail: NTIS HC A08/MF A01 CSCL 22A
As part of the SEASAT program of NASA, a set of four

hemispheric, atmospheric models are developed. The four models use a polar stereographic grid in the horizontal and a sigma coordinate in the vertical. Conservation forms of the difference equations are integrated using either a fifteen or four minute time step on a 381 km or 127 km grid (at 60 deg N) for the 63 x 63 or 187 x 187 models respectively. A nonlinear pressure smoother is used along with momentum and temperature diffusion to help control computational noise. The horizontal boundary conditions are insulated slippery walls. Centered time differencing with time averaging of the pressure gradient force term in the momentum equations is used. Robert time filtering on of the temperature and moisture solutions is used for computational stability. The moisture and heat source/sink terms are modeled. Terms representing evaporation and large scale condensation, sensible heat exchange, parameterized cumulus convection and precipitation, and solar and terrestrial radiation are included. Initialization of the models is based on a pattern conservation technique to obtain objective analysis of the state parameter structure from the surface to 50 mb. G.Y.

N78-28582*# Ocean Data Systems, Inc., Monterey, Calif.
ATMOSPHERIC MODEL DEVELOPMENT IN SUPPORT OF SEASAT. VOLUME 4: FORECAST MODEL SENSITIVITY STUDY Final Technical Report
Howard L. Lewit 30 Sep. 1977 183 p Prepared for JPL 5 Vol.
(Contracts NAS7-100; JPL-954668)
(NASA-CR-157330) Avail: NTIS HC A09/MF A01 CSCL 22A

Atmospheric analysis and prediction models of varying (grid) resolution were developed. The models were tested using real observational data for the purpose of assessing the impact of grid resolution on short range numerical weather prediction. The work statement was amended to include the performance of sensitivity tests using a coarse mesh (63 x 63 x 5 level) prediction model in order to identify and order factors which might mask or impair the utility of SEASAT data on short range weather prediction. Such factors included: initial conditions; topography; surface friction; latent heating; diffusion of momentum and temperature; and computational devices such as tendency truncators, pressure smoothers, and temporal filters. G.Y.

N78-28583*# Ocean Data Systems, Inc., Monterey, Calif.
ATMOSPHERIC MODEL DEVELOPMENT IN SUPPORT OF SEASAT. VOLUME 5: TEST RESULTS WITH FINE-MESH (187 BY 187 BY 10) MODEL Final Technical Report
Philip G. Kesel 30 Sep. 1977 73 p Prepared for JPL 5 Vol.
(Contracts NAS7-100; JPL-954668)
(NASA-CR-157331) Avail: NTIS HC A04/MF A01 CSCL 22A

A model (187 x 187 grid with ten layers) was used to produce a 24 hour forecast using initial conditions for 1200Z, 20 May 1976. This forecast was compared to its five layer counterpart on the 187 x 187 grid and to its 63 x 63 coarse mesh counterpart having the same number of layers. Increases in horizontal resolution lead to significant differences in a one day forecast. Many of these differences represent improvements. Increases in vertical resolution tend to produce smaller impacts on the forecast, except in the region near and above the tropopause. The effect on forecast precipitation is in the 10-20% range, as opposed to the 100% for increases in the horizontal resolution. With respect to model energetics (kinetic energy; square vorticity; square divergence), the model tend to group according to horizontal resolution. The time variations of these parameters show that dynamic initialization is needed to: (1) minimize initialization shock; and (2) stabilize the model context to prevent wash-out of small scale information during the adjustment period (first 6-12 forecast hours). G.Y.

N78-28584# Smithsonian Institution, Washington, D. C.
ASTRONAUT OBSERVATIONS FROM THE APOLLO-SOYUZ MISSION
Farouk El-Baz 1977 410 p refs
Avail: NTIS MF A01; SOD HC

The Earth Observations and Photography experiment was carried out as part of the Apollo-Soyuz Test Project in July 1975. The main goal of the experiment was to utilize the special capabilities of trained observers (namely, the American astronauts of the joint mission) in visually studying and photographing specific Earth features and dynamic phenomena. These special capabilities include the sensitivity of the human eye to subtle color variations (e.g., to desert sands or sea water), and the speed with which the eye-brain interaction results in interpretation of the scene and recognition of important features. This latter capability allows instantaneous selection of important sites for photographic documentation at any moment, which in turn, enhances the quality of photographic data from space platforms. Another goal of the experiment was to establish the role of human observers in future space programs, particularly the space shuttle. A detailed account is presented of the experiment objectives, training of astronauts, preparation of aids for their use, and the results of experiment performance. These details serve as a historical-archival record and as a guide for conducting similar projects in the future. F.O.S.

N78-28585*# Bendix Aerospace Systems Div., Ann Arbor, Mich.
MULTISPECTRAL DATA RESTORATION STUDY Final Report
Navinchandra J. Shah and C. L. Wilson May 1977 84 p refs (Contract NAS5-23384)
(NASA-CR-156790; BSR-4246) Avail: NTIS HC A05/MF A01 CSCL 05B

A digital resampling technique for LANDSAT data is reported that incorporates a deconvolution concept to minimize spatial and radiometric degradation of data during resampling for geometric correction. A quantitative comparison of cubic convolution and digital restoration methods establishes the latter as the superior technique. G.G.

N78-28586*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A LIFE-CYCLE DESCRIPTION OF UNDERGROUND COAL MINING Interim Technical Report
Milton L. Lavin, Chester S. Borden, and John R. Duda 1 Jul. 1978 102 p Prepared for DOE
(Contracts NAS7-100; ET-76-I-01-9036)
(NASA-CR-157346; JPL-Pub-78-26) Avail: NTIS HC A06/MF A01 CSCL 08I

An initial effort to relate the major technological and economic variables which impact conventional underground coal mining systems, in order to help identify promising areas for advanced mining technology is described. The point of departure is a series of investment analyses published by the United States Bureau of Mines, which provide both the analytical framework and guidance on a choice of variables. G.Y.

N78-28587*# Missouri Univ. -Rolla. Dept. of Mining, Petroleum and Geological Engineering.
A MANUAL FOR INEXPENSIVE METHODS OF ANALYZING AND UTILIZING REMOTE SENSOR DATA
C. Dale Elifrits and David J. Barr Jul. 1978 32 p refs
(Contract NAS8-31767)
(NASA-CR-150731) Avail: NTIS HC A03/MF A01 CSCL 05B

Instructions are provided for inexpensive methods of using remote sensor data to assist in the completion of the need to observe the earth's surface. When possible, relative costs were included. Equipment need for analysis of remote sensor data is described, and methods of use of these equipment items are included, as well as advantages and disadvantages of the use of individual items. Interpretation and analysis of stereo photos and the interpretation of typical patterns such as tone and texture, landcover, drainage, and erosional form are described. Similar treatment is given to monoscopic image interpretation, including LANDSAT MSS data. Enhancement techniques are detailed with respect to their application and simple techniques of creating an enhanced data item. Techniques described include additive and subtractive (Diazo processes) color techniques and enlargement of photos or images. Applications of these processes, including mappings of land resources, engineering soils, geology, water resources, environmental conditions, and crops and/or vegetation, are outlined. G.G.

N78-28588# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
GUIDANCE FOR APPLICATION OF REMOTE SENSING TO

ENVIRONMENTAL MANAGEMENT. APPENDIX A: SOURCES OF AVAILABLE REMOTE SENSOR IMAGERY
John R. May Mar. 1978 69 p
(DA Proj. 4A7-62720-A-896)
(AD-A053673; WES-INSTR-M-78-2-App-A) Avail: NTIS HC A04/MF A01 CSCL 14/5

Results are presented of a survey conducted to determine the sources, characteristics, and availability of remotely sensed imagery held by various Federal and state governmental organizations. Data presented were collected primarily by direct contact with Federal and state agencies and through extensive examination of published documents. The remote sensor data identified as a result of the survey comprises two principal categories of data: aircraft and satellite imagery. Data collected during the survey is presented and tabulated under eight general headings: agency or organization (sources), type of imagery, range of scales, coverage areas, coverage period and frequency, availability and characteristics of imagery, products available and cost, and procedures for obtaining imagery. Information concerning sources and availability of remote imagery held by commercial, private, and academic organizations is not presented.
Author (GRA)

N78-28589# Fairchild Imaging Systems, Syosset, N. Y. Night Vision Lab.
DATA PROCESSOR (RPV) Final Report
Jun. 1977 43 p
(Contract DAAG53-76-C-0207)
(AD-A053536; ED-AX-80) Avail: NTIS HC A03/MF A01 CSCL 14/5

This report describes a program for the development, brassboard fabrication and testing of an airborne Solid State CCD Data Processor that demonstrates a method of transmitting a standard TV signal over a narrow bandwidth link by processing the TV signal, using CCD-488 devices in an 'analog storage mode'. The Data Processor brassboard shown in Figure 1, is designed to electrically interface with the Systems Research Laboratory's (SRL) TV Camera, 326-H2 and the Fairchild CCD-488 TV Camera (MV301) and to mechanically interface with the Aquila air frame. GRA

N78-28590# Battelle Pacific Northwest Labs., Richland, Wash.
DEVELOPMENT OF ELECTRICAL AND ELECTROCHEMICAL PROBES FOR DOWN HOLE AND IN-LINE CHEMICAL ANALYSIS OF HIGH PRESSURE, HIGH TEMPERATURE GEOTHERMAL FLUIDS Interim Report, period ending Oct. 1977
M. J. Danielson, O. H. Koski, and D. W. Shannon Nov. 1977 41 p refs
(Contract EY-76-C-06-1830)
(PNL-2459) Avail: NTIS HC A03/MF A01

A high temperature-pressure, thermodynamic reference electrode was developed which was demonstrated to be operative in a simulated geothermal environment up to 250 C containing the contaminants that would affect its operation. An electrodeless conductivity probe was developed for use in the geothermal environment. The design is particularly resistant to the effects of scale deposition. The probe should be useful for measuring salinity, steam/brine ratios in two-phase flow, flashing point, and as a liquid-level control. A large number of sealing materials were investigated for use in the 250 C geothermal environment. The field test of the conductivity probe and reference electrode at East Mesa was a success. The conductivity probe successfully predicted the total dissolved solids content of the brine, and the redox probe data coupled with Pourbaix diagrams indicated FeS and FeS2 as surface film present on the electrodes and test loop. Instantaneous corrosion rate methods were demonstrated to be easily set up and convenient to operate. ERA

N78-28591# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
DEVELOPMENT OF COATINGS FOR CORROSION/EROSION PROTECTION OF INTERNAL COMPONENTS OF COAL GASIFICATION VESSELS Monthly Report, 1-31 Jan. 1978
C. M. Packer and R. A. Perkins 8 Feb. 1978 12 p
(Contract EF-77-C-01-2592)
(FE-2592-4) Avail: NTIS HC A02/MF A01

The conclusion can be reached that these preliminary exploratory studies-with both slurry and plasma/flame coatings--indicate that laser surface fusion is useful in the deposition of corrosion/erosion coatings. This is supported by responses to initial inquires regarding the state of laser technology and its applicability to this type of surface heat treatment. Further experimental work, literature reviews, and industry surveys are necessary. Nevertheless, it appears that sound coatings with controlled compositions can be produced effectively and economically. Furthermore, the process lends itself to self-repair and it appears that the current state-of-the-art will permit scaleup to large components. The program plan oiginally included an evaluation of slurry fusion techniques for the deposition of coatings as well as plasma and flame spray approaches. ERA

N78-28592# Sandia Labs., Albuquerque, N. Mex.
IRRIGATION DATA BASE FOR ARIZONA
I. J. Hall and Sharla G. Vandevender Jan. 1978 27 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0968) Avail: NTIS HC A03/MF A01

Determining the locations in the U.S. where solar energy might be used for irrigation was proposed. One of the first steps in determining these locations is to establish a data base for the agricultural states that extensively use irrigation. The data base must include information on the crops grown, the irrigation wells, and the irrigation pumps. The results of an effort to establish such a data base for the state of Arizona are presented. ERA

N78-28593# Committee on Space Research (COSPAR), Paris (France).
SATELLITE IMAGERY INTERPRETATION: SUGGESTIONS FOR LABORATORY DESIGN
T. T. Alfoeldi (Can. Centre for Remote Sensing, Ottawa) and R. A. Ryerson (Can. Centre for Remote Sensing, Ottawa) May 1976 24 p refs
(Tech-Man-Ser-5) Avail: NTIS HC A02/MF A01

Suggestions for the design, staffing, and instrumentation of a basic satellite imagery analysis laboratory are presented. The cost of the equipment and furniture for the basic laboratory is approximately $60,000. Recommended optimal equipment is also listed. ESA

N78-29038# Joint Publications Research Service, Arlington, Va.
SPACE PHOTOGRAPHY FEATS, OBJECTIVES DESCRIBED
Yuriy Zaytsev *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 70-73 Transl. into ENGLISH from Kierunki (Warsaw), no. 27, 2 Jul. 1978 p 3 (For primary document see N78-29032 19-99)
Copyright. Avail: NTIS HC A06/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N78-28594* National Aeronautics and Space Administration. Pasadena Office, Calif.
RF BEAM CENTER LOCATION METHOD AND APPARATUS FOR POWER TRANSMISSION SYSTEM Patent
Richard M. Dickinson, inventor (to NASA) (JPL) Issued 9 Mar. 1978 7 p Filed 21 May 1976 Supersedes N76-26692 (14 - 17, p 2218) Sponsored by NASA
(NASA-Case-NPO-13821-1; US-Patent-4,088,999; US-Patent-Appl-SN-688852; US-Patent-Class-343-113R; US-Patent-Class-343-119; US-Patent-Class-343-16M) Avail: US Patent Office CSCL 10B

The receiving element in wireless power transmission systems

intercepts the greatest possible portion of the transmitted energy beam. Summing the output energy of all receivers in a planar array makes it possible to determine the location of the center of energy of the incident beam on a receiving array of antenna elements so that the incident beam is in the microwave region.
Official Gazette of the U.S. Patent Office

N78-28595 Tennessee Univ., Knoxville.
ON THE ECONOMIC OPTIMIZATION OF THE MAGNETO-HYDRODYNAMIC-STEAM POWER PLANT Ph.D. Thesis
James Nolen Chapman 1977 148 p
Avail: Univ. Microfilms Order No. 7807683

A model of the entire plant is constructed such that, given a triple of input conditions: combustor pressure, air pre-heat temperature and magnetic field strength, the thermodynamic properties, flow rates and performance of the plant are calculated Cost Estimating Relationships are developed so that capital costs can be estimated from the plant calculation. Then, using a set of typical financial assumptions, the cost of electricity (COE) is calculated. With this model, COE is calculated for a variety of operating conditions. The conditions that give minimum COE are found. Based upon these conditions, a MHD generator is designed and the plant performance calculated for this optimum case. Finally, the sensitivity of the resulting optimum plant to variations in seed flow rate, coal price and heat loss in the combustor is calculated. Dissert. Abstr.

N78-28596 Georgia Inst. of Tech., Atlanta.
OPTIMIZATION OF BRAYTON-RANKINE BINARY CYCLES Ph.D. Thesis
Robert Lyutak Kim 1978 162 p
Avail: Univ. Microfilms Order No. 7808582

A binary cycle is a Brayton cycle which rejects waste heat to a Rankine cycle. Binary cycles can offer high overall plant efficiencies for reasonable gas turbine inlet temperatures which result in fuel conservation and reduced waste heat rejection requirements. The objective of this research is to develop techniques for determining optimum plant configurations and operating conditions for complex binary cycles. A model which describes the efficiency of the binary cycle is established in a form suitable for optimization. Several computer subroutines describing thermodynamic properties of steam are constructed to evaluate the Rankine cycle portion of the binary cycle. For the Brayton cycle, ideal gas law is employed to describe thermodynamic properties of helium. Dissert. Abstr.

N78-28597*# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
ADVANCED SPACE POWER REQUIREMENTS AND TECHNIQUES. TASK 1: MISSION PROJECTIONS AND REQUIREMENTS. VOLUME 1: TECHNICAL REPORT
Malcolm G. Wolfe 1 Mar. 1978 207 p refs
(Contract NASw-3078)
(NASA-CR-157344; ATR-78(7667)-1-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 10B

The objectives of this study were to: (1) develop projections of the NASA, DoD, and civil space power requirements for the 1980-1995 time period; (2) identify specific areas of application and space power subsystem type needs for each prospective user; (3) document the supporting and historical base, including relevant cost related measures of performance; and (4) quantify the benefits of specific technology projection advancements. The initial scope of the study included: (1) construction of likely models for NASA, DoD, and civil space systems; (2) generation of a number of future scenarios; (3) extraction of time phased technology requirements based on the scenarios; and (4) cost/benefit analyses of some of the technologies identified. G.Y.

N78-28598*# RCA Labs., Princeton, N. J.
AUTOMATED ARRAY ASSEMBLY Final Report
R. V. DAiello Dec. 1977 163 p Prepared for DOE and JPL
(Contract NAS7-100; JPL-954352)
(NASA-CR-157317; DOE/JPL-954352-77/4; PRRL-77-CR-54)
Avail: NTIS HC A09/MF A01 CSCL 10A

A general technology assessment and manufacturing cost analysis was presented. A near-term (1982) factory design is described, and the results of an experimental production study for the large-scale production of flat-panel silicon and solar-cell arrays are detailed. G.G.

N78-28599*# Crystal Systems, Inc., Salem, Mass.
HEAT EXCHANGER-INGOT CASTING/SLICING PROCESS, PHASE 1: SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE AREA SILICON SHEET TASK OF THE LOW COST SILICON SOLAR ARRAY PROJECT Final Report, 20 Nov. 1975 - 20 Nov. 1977
Frederick Schmid and Chandra P. Khattak 1 Dec. 1977 203 p refs Prepared for JPL and DOE
(Contracts NAS7-100; JPL-954373)
(NASA-CR-157315; ERDA/JPL-954373-77/4) Avail: NTIS HC A10/MF A01 CSCL 10A

A controlled growth, heat-flow and cool-down process is described that yielded silicon with a high degree of single crystallinity. Even when the seed melted out, very large grains formed. Solar cell samples made from cast material yielded conversion efficiency of over 9%. Representative characterizations of grown silicon demonstrated a dislocation density of less than 100/sq cm and a minority carrier diffusion length of 31 micron. The source of silicon carbide in silicon ingots was identified to be from graphite retainers in contact with silica crucibles. Higher growth rates were achieved with the use of a graphite plug at the bottom of the silica crucible. G.G.

N78-28600*# Pennsylvania Univ., Philadelphia.
HOT FORMING OF SILICON SHEET, SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE AREA SILICON SHEET TASK OF THE LOW COST SILICON SOLAR ARRAY PROJECT Final Report, 12 May - 11 Aug. 1977
C. D. Graham, Jr., D. P. Pope, S. Kulkarni, and M. Wolf 14 Apr. 1978 66 p refs Prepared for DOE and JPL
(Contracts NAS7-100; JPL-954506-78/1)
(ERDA/JPL-954506-78/1) Avail: NTIS HC A04/MF A01 CSCL 10A

The hot workability of polycrystalline silicon was studied. Uniaxail stress-strain curves are given for strain rates in the range of .0001 to .1/sec and temperatures from 1100 to 1380 C. At the highest strain rates at 1380 C axial strains in excess of 20% were easily obtainable without cracking. After deformations of 36%, recrystallization was completed within 0.1 hr at 1380 C. When the recrystallization was complete, there was still a small volume fraction of unrecyrstallized material which appeared very stable and may degrade the electronic properties of the bulk materials. Texture measurements showed that the as-produced vapor deposited polycrystalline rods have a < 110 > fiber texture with the < 110 > direction parallel to the growth direction and no preferred orientation about this axis. Upon axial compression perpendicular to the growth direction, the former < 110 > fiber axis changed to < 111 > and the compression axis became < 110 >. Recrystallization changed the texture to < 110 > along the former fiber axis and to < 100 > along the compression axis. G.G.

N78-28601*# Pennsylvania State Univ., University Park.
BASIC MECHANISMS STUDY FOR MIS SOLAR CELL STRUCTURES ON GaAs Final Report
S. J. Fonash Mar. 1978 39 p refs Prepared for DOE and JPL
(Contract JPL-954525)
(NASA-CR-157332) Avail: NTIS HC A03/MF A01 CSCL 10A

The solar cell structure examined is the MIS configuration on (n) GaAs. The metal room temperature oxide/(n) GaAs materials system was studied. Metals with electronegativities varying from 2.4 (Au) to 1.5 (Al) were used as the upper electrode. The thinnest metallization that did not interfere with the measurement techniques (by introducing essentially transmission line series resistance problems across a device) was used. Photovoltaic response was not optimized. B.B.

N78-28602*# Sensor Technology, Inc., Chatsworth, Calif.
THE 40 kW OF SOLAR CELL MODULES FOR THE LARGE SCALE PRODUCTION TASK A LOW COST SILICON SOLAR ARRAY PROJECT Final Technical Report
Gregory T. Jones Dec. 1977 38 p refs Sponsored by DOE Prepared for JPL

(Contract NAS7-100)
(NASA-CR-157348; DOE/JPL-95465-77/1) Avail: NTIS HC A03/MF A01 CSCL 10A

Forty kilowatts of solar cell modules was produced in this program. This is equivalent to 4123 modules. The average power output per module was 9.7 watts at 16.5 volts, 60 C and 100 mW/sq cm. The peak production rate was 200 modules per week which is equal to 1.9 kW per week. This rate was sustained for over four and one-half months and is equivalent to 100 kW per year. This final report covers the solar cell module design, electrical and power performance, module preproduction environmental test results, production and shipping schedule, program summary, and delivery. A cost analysis section is written. Particular emphasis on the percentage of labor and material utilized in constructing a solar cell module is presented. Also included are cost reduction recommendations. Author

N78-28603*# Spire Corp., Bedford, Mass.
DESIGN AND FABRICATION OF SOLAR CELL MODULES Final Technical Report, Dec. 1976 - May 1977
Thomas P. Shaughnessy Apr. 1978 43 p refs Prepared for DOE and JPL
(Contract JPL-954655)
(NASA-CR-157333; DOE/JPL-954655-78/1-FR; FR-77-10048) Avail: NTIS HC A03/MF A01 CSCL 10A

A program conducted for design, fabrication and evaluation of twelve silicon solar cell modules is described. The purpose of the program was to develop a module design consistent with the requirements and objectives of JPL specification and to also incorporate elements of new technologies under development to meet LSSA Project goals. Module development emphasized preparation of a technically and economically competitive design based upon utilization of ion implanted solar cells and a glass encapsulation system. The modules fabricated, tested and delivered were of nominal 2 X 2 foot dimensions and 20 watt minimum rating. Basic design, design rationale, performance and results of environmental testing are described. G.Y.

N78-28604*# Boeing Aerospace Co., Seattle, Wash.
SIMULATION OF SPACE RADIATION EFFECTS ON POLYIMIDE FILM MATERIALS FOR HIGH TEMPERATURE APPLICATIONS Final Report
Lawrence B. Fogdall and Sheridan S. Cannaday Nov. 1977 42 p refs Prepared for JPL
(Contract JPL-954701)
(NASA-CR-157322) Avail: NTIS HC A03/MF A01 CSCL 10A

Space environment effects on candidate materials for the solar sail film are determined. Polymers, including metallized polyimides that might be suitable solar radiation receivers, were exposed to combined proton and solar electromagnetic radiation. Each test sample was weighted, to simulate the tension on the polymer when it is stretched into near-planar shape while receiving solar radiation. Exposure rates up to 16 times that expected in Earth orbit were employed, to simulate near-sun solar sailing conditions. Sample appearance, elongation, and shrinkage were monitored, noted, and documented in situ. Thermosetting polyimides showed less degradation or visual change in appearance than thermoplastics. G.G.

N78-28605*# Motorola, Inc., Phoenix, Ariz. Semiconductor Group.
STUDIES AND TESTING OF ANTIREFLECTIVE (AR) COATINGS FOR SODA-LIME GLASS Final Report
Edward M. Pastirik, Terry G. Sparks, and Michael G. Coleman May 1978 27 p
(Contract JPL-954773)
(NASA-CR-157323; DOE/JPL-954773-78/1; Rept-2335/1) Avail: NTIS HC A03/MF A01 CSCL 10A

Processes for producing antireflection films on glass are concentrated in three areas: acid etching of glass, plasma etching of glass, and acid development of sodium silicate films on glass. The best transmission was achieved through the acid etching technique, while the most durable films were produced from development of sodium silicate films. Control of the acid etching technique is presently inadequate for production implementation. While films having excellent antireflective properties were fabricated by plasma etching techniques, all were water soluble. G.G.

N78-28606*# California Univ., Los Angeles. School of Engineering and Applied Science.
DELAYED FRACTURE OF SILICON: SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE AREA SILICON SHEET TASK OF THE LOW COST SILICON SOLAR ARRAY PROJECT Final Report
T.-J. Chen and W. J. Knapp 31 Mar. 1978 16 p refs Prepared for JPL and DOE
(Contracts NAS7-100; JPL-954836)
(NASA-CR-157313) Avail: NTIS HC A02/MF A01 CSCL 10A

Bar specimens were cut from ingots of single crystal silicon, and acid etched prior to testing. Artificial surface flaws were introduced in specimens by indentation with a Knoop hardness tester. The specimens were loaded in four-point bending to 95 percent of the nominal fracture stress, while keeping the surface area, containing the flaw, wet with test liquids. No evidence of delayed fracture, and, therefore stress corrosion, of single crystal silicon was observed for liquid environments including water, acetone, and aqueous solutions of NaCl, NH4OH, and HNO3, when tested with a flaw parallel to a (110) surface. The fracture toughness was calculated. J.M.S.

N78-28607*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN IMPROVED METHOD FOR ANALYSIS OF HYDROXIDE AND CARBONATE IN ALKALINE ELECTROLYTES CONTAINING ZINC
Margaret A. Reid 1978 14 p refs To be presented at the 154th meeting of the Electrochem. Soc., Inc., Pittsburgh, 15-20 Oct. 1978
(NASA-TM-78961) Avail: NTIS HC A02/MF A01 CSCL 10C

A simplified method for titration of carbonate and hydroxide in alkaline battery electrolyte is presented involving a saturated KSCN solution as a complexing agent for zinc. Both hydroxide and carbonate can be determined in one titration, and the complexing reagent is readily prepared. Since the pH at the end point is shifted from 8.3 to 7.9 - 8.0, m-cresol purple or phenol red are used as indicators rather than phenolphthalein. Bromcresol green is recommended for determination of the second end point of a pH of 4.3 to 4.4. Author

N78-28608*# AiResearch Mfg. Co., Torrance, Calif.
PRELIMINARY DESIGN STUDY OF AN ALTERNATE HEAT SOURCE ASSEMBLY FOR A BRAYTON ISOTOPE POWER SYSTEM Final Report, Oct. 1977 - Apr. 1978
Hal J. Strumpf May 1978 112 p refs Prepared for JPL
(Contract NAS3-20816)
(NASA-CR-135428; AiResearch-78-15171) Avail: NTIS HC A06/MF A01 CSCL 10A

Results are presented for a study of the preliminary design of an alternate heat source assembly (HSA) intended for use in the Brayton isotope power system (BIPS). The BIPS converts thermal energy emitted by a radioactive heat source into electrical energy by means of a closed Brayton cycle. A heat source heat exchanger configuration was selected and optimized. The design consists of a 10 turn helically wound Hastelloy X tube. Thermal analyses were performed for various operating conditions to ensure that post impact containment shell (PICS) temperatures remain within specified limits. These limits are essentially satisfied for all modes of operation except for the emergency cooling system for which the PICS temperatures are too high. Neon was found to be the best choice for a fill gas for auxiliary cooling system operation. Low cycle fatigue life, natural frequency, and dynamic loading requirements can be met with minor modifications to the existing HSA. B.B.

N78-28609*# Copper Development Association, Inc., New York, N. Y.
COLLATION OF MONTHLY AND SEMIANNUAL REPORTS COVERING INSTRUMENTATION AT THE DECADE 80 HOUSE IN TUCSON, ARIZONA
Jun. 1978 24 p Prepared for DOE
(Contract NAS8-32244)
(NASA-CR-150728) Avail: NTIS HC A02/MF A01 CSCL 10B

The Decade 80 solar house, located in Tucson, Arizona, was built to show the use of copper in home building and to demonstrate the use of solar energy to provide space heating and cooling and domestic hot water. The auxiliary energy sources are electrical resistance heating for the domestic hot water and a gas fired boiler for space heating and operation of the absorption air conditioning units. The Semi-Annual report gives an overview of the instrumentation effort with the back-up monthly reports reflecting more detail of the effort that went into the implementation of the data acquisition system. G.Y.

N78-28610*# Moseley (Terrell E.), Inc., Lynchburg, Va.
SOLAR HEATING SYSTEM INSTALLED AT LYNCHBURG, VIRGINIA
1 Dec. 1976 174 p
(Contract E(49-18)-2388)
(NASA-CR-150729) Avail: NTIS HC A08/MF A01 CSCL 10B

A solar space and domestic hot water preheating system was designed and installed in a retrofitted 1780 sq ft office building. The 400 sq ft. water cooled flat plate collector is mounted facing south at a 50 deg slope on the flat roof of an adjoining warehouse which shelters a 2,000 gal insulated steel tank with a Bitumastic interior lining. In addition to the collector and the tank, the system comprises a gas auxilliary boiler, a duct distribution system utilizing a hot water duct coil and water-to-air heat pump, and a hot water preheater. The system is fully automatic. Installation, operation, and maintenance instructions are included. A.R.H.

N78-28611*# Copper Development Association, Inc., New York, N. Y.
DESIGN PACKAGE FOR INSTRUMENTATION OF THE DECADE 80 HOUSE IN TUCSON, ARIZONA
Jul. 1978 58 p Prepared for DOE
(Contract NAS8-32244)
(NASA-CR-150730) Avail: NTIS HC A04/MF A01 CSCL 10A

A design package covering instrumentation and system design for the Decade 80 House in Tucson, Arizona is presented. The solar house is instrumented for the purpose of gathering data to determine the solar heating and cooling system performance. The use of copper in the construction of the house is a first choice construction material because it conducts heat and resists corrosion better than other materials and therefore provides a more efficient and economical system. Equipment and site specifications are reported, along with floor plans showing the location of the site instrumentation hardware. G.Y.

N78-28612*# Honeywell, Inc., Minneapolis, Minn.
SOLAR HEATING AND COOLING SYSTEMS DESIGN AND DEVELOPMENT Quarterly Report, 1 Jan. - 31 Mar. 1978
Jul. 1978 20 p Prepared for DOE
(Contract NAS8-32093)
(NASA-CR-150732) Avail: NTIS HC A02/MF A01 CSCL 10A

The development and delivery of eight prototype solar heating and cooling systems for installation and operational test are outlined for single-family residences, and commercial applications. G.G.

N78-28613*# General Electric Co., Philadelphia, Pa.
SOLAR HEATING AND COOLING SYSTEM DESIGN AND DEVELOPMENT Status Summary through Dec. 1977
6 Apr. 1978 26 p Prepared for DOE
(Contract NAS8-32092)
(NASA-CR-150735) Avail: NTIS HC A03/MF A01 CSCL 10A

Application surveys and performance studies were conducted to determine a solar heating and hot water configuration that could be used in a variety of applications, and to identify subsystem modules that could be utilized in a building block fashion to adapt hardware items to single and multi-family residential and commercial systems. Topics discussed include: subsystem development for the solar collectors, controls, other components, energy management module, and the heating system configuration test. Operational tests conducted at an Illinois farmhouse, and a YWCA in Spokane, Washington are discussed. A.R.H.

N78-28614*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF THREE EXPERIMENTAL METHODS USED IN DETERMINING THE THERMAL PERFORMANCE OF FLAT-PLATE SOLAR COLLECTORS Ph.D. Thesis - Kansas Univ.
Gregory B. Hotchkiss Oct. 1978 289 p refs
(NASA-TM-78929; E-9669) Avail: NTIS HC A13/MF A01 CSCL 10A

Three experimental methods for evaluating the thermal performance of flat-plate solar collectors are presented. The methods are classified according to the nature of the ambient conditions encountered during experimental testing. The classifications are: (1) steady state, (2) quasi-steady state, and (3) unsteady state. Experimental tests on two solar collectors were conducted in an indoor solar simulator and also out-of-doors. From the experimental collector data, collector efficiency factors, which describe the steady state behavior of a collector, were determined for each experimental method. A parameter identification method based upon a discrete gradient optimization technique was used to determine the collector parameters from unsteady state data. Such a method would allow on-line data reduction and would enable speedy determination of the collector efficiency factors from transient data. The design, construction, and operation of the test rig which was used to obtain the experimental data are also described. Author

N78-28615*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EMERGING ENERGY ALTERNATIVES FOR THE SOUTHEASTERN STATES
Elias K. Stefanakos, ed. 1978 149 p refs Proc. of Symp. held at North Carolina A and T State Univ., Greensboro, 31 Mar. 1978; sponsored by DOE and North Carolina A and T State Univ.
(NASA-CP-2042; L-12251) Avail: NTIS HC A07/MF A01 CSCL 10A

The proceedings of the first symposium on emerging energy alternatives for the Southeastern States are presented. Some topics discussed are: (1) solar energy, (2) wood energy, (3) novel energy sources, (4) agricultural and industrial process heat, (5) waste utilization, (6) energy conservation and (7) ocean thermal energy conversion. For individual titles, see N78-28616 through N78-28623.

N78-28616*# Tennessee Technological Univ., Cookeville.
AN OVERVIEW OF THE ENERGY SITUATION
Donald R. Pitts *In* NASA. Langley Res. Center Emerging Energy Alternatives for the Sourtheastern States 1978 p 7-18
(For primary document see N78-28615 19-44)
Avail: NTIS HC A07/MF A01 CSCL 10A

Beginning with a historical review of the domestic pattern of energy usage, the current dependence of the United States upon dwindling petroleum resources is examined. The possible limit of petroleum usage is discussed, and recent oil production trends are presented. Coupling these with projected analyses of OPEC oil productive capability in the early 1980's indicates a serious worldwide as well as American energy problem in the next decade. The need for conservation and rapid development of application of alternative energy resources is discussed including quantitative projections of significant conservation efforts as well as estimates of domestic alternative energy resource capabilities. L.S.

N78-28617*# Sandia Labs., Albuquerque, N. Mex.
ALTERNATIVES IN SOLAR ENERGY
Donald G. Schueler *In* NASA. Langley Res. Center Emerging Energy Alternatives for the Southeastern States 1978 p 19-25 refs Sponsored by DOE (For primary document see N78-28615 19-44)
Avail: NTIS HC A07/MF A01 CSCL 10A

Although solar energy has the potential of providing a significant source of clean and renewable energy for a variety of applications, it is expected to penetrate the nation's energy economy very slowly. The alternative solar energy technologies

which employ direct collection and conversion of solar radiation as briefly described. Author

N78-28618*# Ultrasystems, Inc., Washington, D. C.
WOOD ENERGY-COMMERCIAL APPLICATIONS
Robert P. Kennel *In* NASA. Langley Res. Center Emerging Energy Alternatives for the Southeastern States 1978 p 27-38 refs (For primary document see N78-28615 19-44)
Avail: NTIS HC A07/MF A01 CSCL 10A

Wood energy is being widely investigated in many areas of the country because of the many obvious benefits of wood fuel such as the low price per million Btus relative to coal, oil, and gas; the wide availability of noncommercial wood and the proven ability to harvest it; established technology which is reliable and free of pollution; renewable resources; better conservation for harvested land; and the potential for jobs creation. The Southeastern United States has a specific leadership role in wood energy based on its established forest products industry experience and the potential application of wood energy to other industries and institutions. Significant questions about the widespread usage of wood energy are being answered in demonstrations around the country as well as the Southeast in areas of wood storage and bulk handling; high capitalization costs for harvesting and combustion equipment; long term supply and demand contracts; and the economic feasibility of wood energy outside the forest products industry. Author

N78-28619*# Old Dominion Univ., Norfolk, Va.
IMPACT OF NOVEL ENERGY SOURCES: OTEC, WIND, GOETHERMAL, BIOMASS
A. Sidney Roberts, Jr. *In* NASA. Langley Res. Center Emerging Energy Alternatives for the Southeastern States 1978 p 39-57 refs (For primary document see N78-28615 19-44)
Avail: NTIS HC A07/MF A01 CSCL 10A

Alternate energy conversion methods such as ocean thermal energy conversion (OTEC), wind power, geothermal wells and biomass conversion are being explored, and re-examined in some cases, for commercial viability. At a time when United States fossil fuel and uranium resources are found to be insufficient to supply national needs into the twenty-first century, it is essential to broaden the base of feasible energy conversion technologies. The motivations for development of these four alternative energy forms are established. Primary technical aspects of OTEC, wind, geothermal and biomass energy conversion systems are described along with a discussion of relative advantages and disadvantages of the concepts. Finally, the sentiment is voiced that each of the four systems should be developed to the prototype stage and employed in the region of the country and in the sector of economy which is complimentary to the form of system output. Author

N78-28620*# Department of Energy, Washington, D. C. Office of Solar Applications.
AGRICULTURAL AND INDUSTRIAL PROCESS HEAT
James Dollard *In* NASA. Langley Res. Center Emerging Energy Alternatives for the Southeastern States 1978 p 59-86 refs (For primary document see N78-28615 19-44)
Avail: NTIS HC A07/MF A01 CSCL 10A

The application of solar energy to agricultural and industrial process heat requirements is discussed. This energy end use sector has been the largest and it appears that solar energy can, when fully developed and commercialized, displace from three to eight or more quads of oil and natural gas in U.S. industry. This potential for fossil fuel displacement in the agricultural and industrial process heat area sector represents a possible savings of 1.4 to 3.8 million barrels of oil daily. L.S.

N78-28621*# Department of Energy, Washington, D. C.
CONSERVATION AS AN ALTERNATIVE ENERGY SOURCE
Donald E. Allen *In* NASA. Langley Res. Center Emerging Energy Alternatives for the Southeastern States 1978 p 87-94 (For primary document see N78-28615 19-44)
Avail: NTIS HC A07/MF A01 CSCL 10A

A speech is given outlining the energy situation in the United States. It is warned that the existing energy situation cannot prevail and the time is fast running out for continued growth or even maintenance of present levels. Energy conservation measures are given as an aid to decrease U.S. energy consumption, which would allow more time to develop alternative sources of energy. L.S.

N78-28622*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE IMPACT OF MUNICIPAL REFUSE UTILIZATION ON ENERGY AND OUR ENVIRONMENT
In its Emerging Energy Alternatives for the Southeastern States 1978 p 95-116 (For primary document see N78-28615 19-44)
Avail: NTIS HC A07/MF A01 CSCL 10A

The incinerator/boiler configuration is stressed as the most reliable method of waste utilization. It is also pointed out that the high cost of refuse disposal and the ever increasing cost of energy, have made this method attractive. A plan is outlined for operating a waste utilization plant. Community participation is encouraged in investigating the feasibility of refuse to energy facilities in their area. L.S.

N78-28623*# Oak Ridge Associated Universities, Tenn.
HOW MUCH ENERGY DOES ENERGY COST?
Warren D. Devine, Jr. *In* NASA. Langley Res. Center Emerging Energy Alternatives for the Southeastern States 1978 p 117-134 refs (For primary document see N78-28615 19-44)
Avail: NTIS HC A07/MF A01 CSCL 10A

Estimating the energy cost of producing and delivering an energy product involves the quantitative determination of all relevant energy flows and the aggregation of these flows into meaningful indices of system performance. Five emerging energy technologies are subjected to energy analysis. The energy delivered by each is substantially greater than the energy consumed during construction and lifelong operation of the system. Net energy analysis can provide interesting and perhaps useful information regarding specific technologies, but it does not necessarily provide additional information essential to the making of decisions regarding those technologies. L.S.

N78-28624*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLUBILITY, STABILITY, AND ELECTROCHEMICAL STUDIES OF SULFUR-SULFIDE SOLUTIONS IN ORGANIC SOLVENTS
William L. Fielder and Joseph Singer Aug. 1978 43 p refs (NASA-TP-1245; E-9552) Avail: NTIS HC A03/MF A01 CSCL 10A

A preliminary study of the sulfur electrode in organic solvents suggests that the system warrants further investigation for use in a low temperature (100 deg to 120 C) Na-S secondary battery. A qualitative screening was undertaken at 120 C to determine the solubilities and stabilities of Na2S and Na2S2 in representatives of many classes of organic solvents. From the screening and quantitative studies, two classes of solvents were selected for work; amides and cyclic polyalcohols. Voltammetric and Na-S cell charge discharge studies of sulfide solutions in organic solvents (e.g., N, N-dimethylformamide) at 120 C suggested that the reversibilities of the reactions on Pt or high density graphite were moderately poor. However, the sulfur electrode was indeed reducible (and oxidizable) through the range of elemental sulfur to Na2S. Reactions and mechanisms are proposed for the oxidation reduction processes occurring at the sulfur electrode. Author

N78-28625*# National Aeronautics and Space Administration. Pasadena Office, Calif.
DRIVER FOR SOLAR CELL I-V CHARACTERISTIC PLOTS
Patent Application
Gary B. Turner, inventor (to NASA) (JPL) Filed 26 Jul. 1978 15 p
(Contract NAS7-100)
(NASA-Case-NPO-14096-1; US-Patent-Appl-SN-928128) Avail: NTIS HC A02/MF A01 CSCL 10A

An apparatus for the evaluation of the current versus voltage (I-V) parameter of solar cells is described. The apparatus can be used in laboratory research and production quality control. An I-V graph for a solar cell produced with the driver was illustrated in such a way that the solar cell is driven from a short circuit condition to an open circuit condition. A load line moves to a position A'-B' through the origin and the approximate center of the knee in the curve, and from there to the final position A'-B'. The rate that the load line moves is constant

so that the recording rate from B to B' is approximately the same as from B' to A'. NASA

N78-28626*# National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD OF FABRICATING A PHOTOVOLTAIC OF A SUBSTANTIALLY TRANSPARENT CONSTRUCTION Patent Application
Paul A. Dillard (Lockheed Missile and Space Co., Inc., Sunnyvale, Calif.), Walter M. Fritz (Lockheed Missile and Space Co., Inc., Sunnvale, Calif.), and Dan R. Lott, inventors (to NASA) (Lockheed Missile and Space Co., Inc., Sunnyvale, Calif.) Filed 26 Jul. 1978 12 p
(Contracts NAS7-100)
(NASA-Case-NPO-14303-1; NASA-Case-NPO-14305-1; US-Patent-Appl-SN-928133) Avail: NTIS HC A02/MF A01 CSCL 10A

A method of fabricating a photovoltaic module transparent to all energy not used by the cells to produce electricity was examined. The method is characterized by the steps of registering a plurality of uniformly dimensioned photovoltaic cells of circular configurations, with a plurality of circular openings formed in a planar tool for affording access to the P contact surface of each of the cells. The N contact surface of alternate cells was connected to the P contact surface of the cells interposed between, removing residue from solder flux. NASA

N78-28627# EIC, Inc., Newton, Mass.
LITHIUM-INORGANIC ELECTROLYTE BATTERIES Final Report, 17 Sep. 1973 - 30 Sep. 1977
Joseph R. Driscoll, S. Barry Brummer, Peter Gudrais, Gerhard L. Holleck, and David E. Toland Mar. 1978 89 p refs
(Contract DAAB07-74-C-0030)
(AD-A053378; C-401; ECOM-74-0030-F) Avail: NTIS HC A05/MF A01 CSCL 10/3

This is the Final Report on ECOM Contract DAAB07-74-C-0030. It contains the results of work for the period September 1973-September 1977. This report summarizes our research and development effort on the Li/thionyl chloride battery system. The work on this program has centered along two lines: We have investigated the reaction stoichiometry of the cell discharge via chemical analysis of the reaction products; we have also investigated the problem of Li/SOCl2 cell passivation during storage at 71 C (160 F), with a particular view to finding practical solutions. Analytical measurements were carried out on complete Li/SOCl2 cells. Qualitative tests identified three discharge products, LiCl, S and SO2. Quantitative analyses were performed for these species. Of the several stoichiometries that can be written, the one most closely corresponding to the data is: 4Li 2SOCl2 yields 4LiCl + S + SO2. The analytical data for LiCl and S correspond to this reaction. The SO2 is, however, twice the value predicted by this reaction. A reaction between S and SOCl2 which generates SO2 during the analysis may account for this. No other simple reaction stoichiometry corresponds to these analyses. Near UV spectrophotometry was investigated as an analytical tool for the SOCl2 system. The results of these experiments indicate that UV spectrophotometric techniques are a useful method for studying the Li/SOCl2 system and, further, that it is possible to study the mechanism of SOCl2 reduction in dilute solutions of organic solvents. GRA

N78-28628# Battelle Pacific Northwest Labs., Richland, Wash.
SUMMARY OF THE DEVELOPMENT PLAN FOR THE WIND CHARACTERISTICS PROGRAM ELEMENT OF THE FEDERAL WIND ENERGY PROGRAM
C. E. Elderkin and L. L. Wendell Oct. 1977 53 p refs
(Contract EY-76-C-06-1830)
(PNL-2501) Avail: NTIS HC A04/MF A01

The Wind Systems Branch (WSB) of the Solar Technology Division of DOE is responsible for the FWEP and has divided the program into several program elements. The focus of this report is on the development of the Wind Characteristics Program Element (WCPE). The development plan presented contains a detailed breakdown of the proposed program for FY 1978 and a program overview and projection through FY 1980. The basic document provides a basis for communication between the WSB and the WCPE and will be continually updated as required to accomplish the overall objectives of the FWEP. This summary document is aimed at apprising the participant and user communities of the aims and priorities of the WCPE. ERA

N78-28629# Oak Ridge National Lab., Tenn.
TEST OF 6-INCH-THICK PRESSURE VESSELS. SERIES 3: INTERMEDIATE TEST VESSEL V-7A UNDER SUSTAINED LOADING
R. H. Bryan, T. M. Cate, P. P. Holz, T. A. King, J. G. Merkle, G. C. Robinson, G. C. Smith, J. E. Smith, and G. D. Whitman 1 Feb. 1978 291 p refs
(Contract W-7405-eng-26)
(ORNL/NUREG-9) Avail: NTIS HC A13/MF A01

HSST intermediate test vessel V-7 was repaired after being tested hydrostatically to leakage and was retested pneumatically as vessel V-7A. Except for the method of applying the load, the conditions in both tests were nearly identical. In each case, a sharp outside surface flaw 547 mm long by about 135mm deep was prepared in the 152-mm-thick test cylinder of A533, grade B, class 1 steel. The inside surface of vessel V-7A was sealed in the region of the flaw by a thin metal patch so that pressure could be sustained after rupture. Vessel V-7A failed by rupture of the flaw ligament without burst, as expected. Rupture occurred at 144.3 MPa after which pressure was sustained for 30 min without any indication of instability. The rupture pressure of vessel V-7A was about 2 percent less than that of vessel V-7. ERA

N78-28630# Fluor Engineers and Constructors, Inc., Irvine, Calif.
ECONOMIC STUDIES OF COAL GASIFICATION: COMBINED CYCLE SYSTEMS FOR ELECTRIC POWER GENERATION Final Report
K. Chandra, B. McElmurry, E. W. Neben, and G. E. Pack Jan. 1978 459 p refs Sponsored by EPRI
(EPRI Proj. 239)
(EPRI-AF-642) Avail: NTIS HC A20/MF A01

The objective was to identify whether significant economic and/or environmental incentives exist for using such systems compared to the current practice of direct coal firing and stack gas cleanup. The processes studied included the Lurgi dry ash gasifier, the British Gas Corporation slagger, and three entrained-bed processes. All these processes were integrated with combined-cycle plants based on advanced gas turbine technology (2,400 F combustion outlet) estimated to be available in the 1981-1985 time period. The evaluations were based on complete grass-roots facilities sized to conform to the present electric utility practice of building units of approximately 1,000-MW capacity. It is concluded that several of the processes considered are potentially attractive and are, or can be, available for commercialization during the next decade. ERA

N78-28631# Sandia Labs., Albuquerque, N. Mex.
MINICOMPUTER BASED DATA ACQUISITION AND ANALYSIS SYSTEMS FOR VERTICAL AXIS WIND TURBINE TESTING
B. Stiefeld and R. Tomlinson 1978 10 p ref Presented at the 24th Intern. Instrumentation Symp., Albuquerque, N. Mex., 1 May 1978
(Contract EY-76-C-04-0789)
(SAND-78-0187C; Conf-780503-4) Avail: NTIS HC A02/MF A01

The computer based data acquisition system and instrumentation used to acquire environmental, structural, and performance data from the VAWT complex are described. An airborne type PCM encoder mounted on the turbine shaft is used to digitize much of the data, particularly the low level strain information from the turbine blades and supporting structure. The data system is an extension of recently completed work on a similar system for a large, 8.8 meter (25 foot) centrifuge facility. Computer software which provides near real time graphic and analytic capabilities is also described. ERA

N78-28632# Sandia Labs., Albuquerque, N. Mex. Advanced Energy Projects.
PRELIMINARY BLADE STRAIN GAGE DATA ON THE SANDIA 17-METER VERTICAL-AXIS WIND TURBINE
W. N. Sullivan Dec. 1977 20 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1176) Avail: NTIS HC A02/MF A01

Results are summarized from blade strain measurements made during the initial operating period of 17 M turbine. The measurements indicate that the blade structure is performing adequately, without any apparent fatigue life consumption or excessive vibration. The test results cover a range of turbine speeds (from 29.6 to 59.3 RPM) and wind speeds (from negligible to 50 MPH). ERA

N78-28633# Brookhaven National Lab., Upton, N. Y.
UTILIZATION OF ENERGY: INFORMATION REQUIREMENTS FOR POLICY
Kenneth C. Hoffman Nov. 1977 32 p refs Presented at the Workshop on Energy Inform., Stanford, Calif., 15-16 Dec. 1977
(Contract EY-76-C-02-0016)
(BNL-23643; Conf-771226-1) Avail: NTIS HC A03/MF A01

An integrated approach involving the use of aggregated energy-economic data, as well as more detailed data at the activity level involving the characterization of specific energy utilization processes in the residential, commercial, and industrial sectors is outlined. Such information goes beyond the traditional treatment of resources utilization and delivered fuels to incorporate the concepts of energy services delivered, and of the direct plus indirect energy content of goods and services that are consumed. The present situation is, therefore, one of transition from a period where analysis was governed by the availability of data to one where information must be developed to support the needs of policy analysis. The current information base is summarized and recommendations are made for the future development of an information base and analytical capability that will support energy-utilization policy analysis. ERA

N78-28634# California Univ., Berkeley. Lawrence Berkeley Lab.
CONVOLUTION PRINCIPLE AS APPLIED TO THE HEAT TRANSFER PROBLEMS OF BUILDINGS AND FUNDAMENTALS OF ITS EFFICIENT USE
Metin Lokmanhekim Aug. 1977 6 p refs Presented at the Conf. on Heat Transfer in Buildings, Belgrade, 29 Aug. - 2 Sep. 1977
(Contract W-7405-eng-48)
(LBL-6866; Conf-770886-1) Avail: NTIS HC A02/MF A01

The Convolution Principle used with computer programs to compute heat gain or loss through a building wall or roof, the exterior temperature of a wall or roof, and the resulting loads for heating or cooling the building is discussed. Author (ERA)

N78-28635# Georgetown Univ., Washington, D.C.
GEORGETOWN UNIVERSITY COAL USING-INTEGRATED COMMUNITY ENERGY SYSTEM (GU/CU-ICES) DEMONSTRATION PROJECT. PHASE 1: DETAILED WORK MANAGEMENT PLAN Final Report, Aug. 1977 - Jan. 1978
31 Jan. 1978 167 p refs
(Contract EC-77-C-02-4488)
(COO-4488-1) Avail: NTIS HC A08/MF A01

The energy conservation potential of a heat and power generating system using a coal-fired atmospheric pressure fluidized bed combustor to supply all energy needs to operate the university buildings was studied. A prefeasibility study determined a group of ten subsystems that were directly related to the goals of the program. These included cogeneration from a steam turbine, grid connection, diesel cogeneration, desiccant regeneration in HVAC dehumidification, heat pumping to a higher temperature, seasonal energy storage, cool storage of thermal energy, heat storage, coal and limestone storage and transportation, and the combustor solid waste disposal. The goals and the subsystem alternatives, a comprehensive scope of work, detailed task plan, schedules and a management plan are defined. ERA

N78-28636# Oak Ridge National Lab., Tenn.
COMMERCIAL ENERGY USE: A DISAGGREGATION BY FUEL, BUILDING TYPE, AND END USE
Jerry R. Jackson and William S. Johnson Feb. 1978 94 p
(Contract W-7405-eng-26)
(ORNL/CON-14) Avail: NTIS HC A05/MF A01

The development of detailed estimates of energy use in the commercial sector is described. The level of detail includes five end uses, four fuel types, and ten commercial subsectors. Energy use estimates for each of the 200 components are developed for the years 1965 to 1975. Trends in commercial energy use by fuel type and end use are presented; energy use estimates disagregated by building type, fuel, and end use are presented for 1970 and 1975. The three distinct tasks required to develop these estimates are presented in detail. The first task includes reviewing, analyzing, and interpreting data on commercial energy use to reflect consistent commercial sector coverage. Floor space stock estimates are developed in the second task. In the third step, information on relative energy use by building type is synthesized from studies of individual buildings and is used, along with aggregate fuel and floor space estimates, to calculate detailed energy use by subsector and year. ERA

N78-28637# Thermo Electron Corp., Waltham, Mass.
ERDA/NASA ADVANCED THERMIONIC TECHNOLOGY PROGRAM Progress Report
Jun. 1977 17 p
(Contract EY-76-C-02-3056)
(COO-3056-26; PR-24) Avail: NTIS HC A02/MF A01

Work function measurements on LaB6, YB6, and EuB6 are reported. Plasma studies are discussed, and the status of converter development is outlined. Hot shell development progress for using thermionic converters in topping cycles of fossil fueled power plants is discussed. Author (ERA)

N78-28638# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.
CHOICES IN THE NEXT ENERGY AND SOCIAL REVOLUTION
Charles J. Ryan 7 Jul. 1977 28 p
(Contract EX-76-A-01-2195-028)
(TID-28197) Avail: NTIS HC A03/MF A01

As fossil fuels, the energy source of industrialization, are depleted, the world enters into the third most important energy and social revolution in the development of civilization. Natural and social systems operate under the same principles of energy management. The evolution of civilization over more than a million years can be seen as a successful quest to control greater amounts of energy through social organization in three different energy and social systems: hunting and gathering, agriculture, and fossil fuels. The energy perspective of the paper suggests the relationship between continuous growth and social discontinuity in U.S. history. The physical and social consequences of future energy alternatives are discussed in terms of an Orwellian, Jeffersonian, and Malthusian type future (The Third Revolution: Orwell, Jefferson, or Malthus). The paper concludes with an endorsement of solar energy as the alternative most likely to afford a stable future in a humanly organized environment. ERA

N78-28639# General Atomic Co., San Diego, Calif.
RADIOISOTOPE SPACE POWER GENERATOR Annual Report, 1 Jul. 1975 - 30 Sep. 1976
N. B. Elsner, J. Chin, H. G. Staley, E. J. Steeger, and P. K. Gantzel Sep. 1977 101 p refs
(Contract EY-76-C-03-0167-060)
(GA-A-14629) Avail: NTIS HC A06/MF A01

The TPM-217 P-type selenide usefulness in thermoelectric converters depends on its dimensional, electrical and thermal stability at high temperature and its compatibility with other converter component materials in a low pressure environment. Experimental efforts were directed at determining: (1) the vaporization behavior at 900 C, (2) the partial pressures of vaporizing species versus temperature, (3) vapor suppression coatings, (4) thermal expansion, (5) dimensional stability, and (6) the high temperature compatibility of TPM-217 with proposed end cap materials. ERA

N78-28640# York Coll., Jamaica, N. Y.
SPACE-TIME TEMPERATURE PROFILES FOR CONDUCTIVE HEAT FLOW IN COUNTRY ROCK SURROUNDING HOT INTRUSIVE BODIES
M. S. Spergel and P. W. Levy 1977 8 p refs Presented at 15th Intern. Thermal Conductivity Conf., Ottawa, Ontario, Canada, 24 Aug. 1977
(Contract EY-76-C-02-0016)
(BNL-23571; Conf-770847-4) Avail: NTIS HC A02/MF A01

Temperature vs distances profiles during geological time were

calculated for a variety of realistically shaped magmatic bodies intruded into country rock. The calculations were made with a computerized finite difference formulation of the classical time dependent conductive heat flow equation. The formulation can be adopted to numerous situations. These include: (1) emplacement at different rates, (2) variations in the shape of the intrusion, e.g., domed cylinders, cones, or (3) even arbitrary shapes as determined by field measurements. The intrusions may remain in contact with or become isolated from the magma pool. Also, the thermodynamic properties of the intrusion may be adjusted, to include latent heat of fractional crystallization. The surrounding rock may be homogeneous or strata of different kinds of rock. The surface above the intrusion may assume any reasonable shape. ERA

N78-28641# Wormser Scientific Corp., Stamford, Conn.
SOLAR HOUSE HEATING SYSTEM USING REFLECTIVE PYRAMID OPTICAL CONDENSING SYSTEM. Progress Report, 1 Jun. - 31 Dec. 1976
Jan. 1978 83 p
(Contract EY-76-C-02-2769)
(COO-2769-5) Avail: NTIS HC A05/MF A01

The prototype system, previously built on Westover Road, Stamford, Connecticut, was upgraded, instrumented, and evaluated. It was found to perform essentially as expected, but the open construction was found to have problems. A fully enclosed model Pyramidal Optics house was built by Better Homes of Delaware near Rehoboth, Delaware. After a number of significant improvements were made in the optical concentrating system and the flat plate receiver assembly, the system was monitored throughout the winter of 1976/1977 and found to perform very well. The solar contribution to heating amounted to 70 percent during the severe winter months and is expected to exceed 80 percent throughout the year. The Pyramidal Optics system was found to have a number of economic and operational advantages. It is planned to evaluate additional systems in other locations and different climatic conditions. ERA

N78-28642# Stuttgart Univ. (West Germany). Inst. fuer Kernenergetik und Energiesysteme.
HEAT STORE FOR SOLAR ENERGY UTILIZATION IN HEATING SYSTEMS AND WATER HEATING
A. Abhat May 1977 25 p In GERMAN Presented at the Energy Policies Forum of the Landesregierung, Stuttgart, 9 May 1977
(IKE-5-206; Conf-770592-4) Avail: NTIS HC A02/MF A01

After a survey of the main parameters for heat store construction, a new latent-heat store concept is described which takes account of the experience with stores in existing solar houses. The new concept is based on a modular construction. Each module has a finned heat pipe partitioned into 3 compartments (store space, heat source region, and heat sink region). The space between the fins is filled with a storage material which changes from the solid to the liquid phase when heat is added. The test model was operated with paraffin and wax ester. Finally, a proposal is made for an integration of the latent-heat store concept into a solar space and water heating system. ERA

N78-28643# Polyset, Inc., Manchester, Mass.
DEVELOPMENT OF A FREEZE-TOLERANT SOLAR WATER HEATER USING CROSSLINKED POLYETHYLENE AS A MATERIAL OF CONSTRUCTION Final Report, 18 Jun. 1976 - 1 Oct. 1977
J. M. Bradley Jan. 1978 45 p refs
(Contract EY-76-C-02-2956)
(COO-2956-8) Avail: NTIS HC A03/MF A01

The feasibility of building a freeze-tolerant absorber for a solar water heater out of carbon-black-reinforced crosslinked polyethylene was explored. Ten-foot tube specimens made from various crosslinked polyethylene formulations were filled with water at various pressures, and then placed into a deep freeze, then thawed and frozen again for 100 freeze-thaw cycles, or until the tube specimen failed. Five tube specimens containing water at as high as 80 psi survived 100 freeze-thaw cycles. Also, a flat plate collector was fabricated using as absorber surface a single 400 ft tube of carbon-black-reinforced crosslinked polyethylene in the form of a flat spiral coil. The performance test indicated that the absorbency of such a flat spiral coil to solar radiation is similar to typical black surfaces used on solar absorbers. Thus, it does seem very feasible that domestic water can be directly heated in a solar collector having an absorber made from crosslinked polyethylene, and that this collector can safely withstand at least 100 freeze-thaw cycles. ERA

N78-28644# Boeing Engineering and Construction, Seattle, Wash.
CLOSED-CYCLE, HIGH-TEMPERATURE CENTRAL RECEIVER CONCEPT FOR SOLAR ELECTRIC POWER Final Report
Jan. 1978 279 p refs
(EPRI Proj. 377-1)
(EPRI-ER-629) Avail: NTIS HC A13/MF A01

The technical feasibility of a high-temperature central receiver in a solar plant employing closed-cycle helium as a heat transport fluid was examined in terms of system life, efficiency, cost, and technology requirements. These considerations were implemented in the conceptual design of a receiver and its components for utilization in a solar plant of 100 megawatts of electrical power output. The rationale is provided that supports the configuration, equipment arrangement, and material choices. Thermal cycling tests simulating 30-year lifetime of the receiver's heat exchangers at temperatures to 816 C and at 500 psi helium pressure, confirmed material choices. Preliminary design considerations are presented for a 1 megawatt thermal test receiver and for a 10 megawatt electrical pilot plant. Also, a system/supporting-subsystem definition is presented for employing the central receiver design in a solar plant. This includes conceptual design of several thermal energy storage devices and their integration into plant operation. ERA

N78-28645# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION SOLAR ENERGY STUDIES. SOLAR RADIATION INCIDENT ON INCLINED SURFACES IN MELBOURNE
1977 99 p
(SR-MEL-1) Avail: NTIS HC A05/MF A01

A technique was used which computes the radiation incident on a plane inclined at any angle and oriented in any direction, using only the measured hourly values of global radiation on a horizontal surface. Program PRERAD was used for the preparation of tables, predicts total insolation on a selected plane either in the form of hourly values of radiation day by day, or daily averages month by month for a number of years. Author (ERA)

N78-28646# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
WASTE HEAT MANAGEMENT IN THE ELECTRIC POWER INDUSTRY: ISSUE OF ENERGY CONSERVATION AND STATION OPERATION UNDER ENVIRONMENTAL CONSTRAINTS Progress Report, 1 Jun. - 31 Dec. 1977
Jan. 1978 15 p ref
(Contract EY-76-S-02-4114)
(COO-4114-4) Avail: NTIS HC A02/MF A01

Progress in identifying costs, and in particular operating costs, associated with the use of various cooling systems for reducing the thermal impact from base load steam electric power plants is reported. Costs for a single, hypothetical river site are compared. The essential methodology and preliminary results are summarized. A 1200 MWe nuclear plant and an 800 MWe fossil fuel plant were studied. Open cycle diffusers, cooling ponds, mechanical and natural draft evaporative towers and mechanical draft dry towers were considered for both plants. A set of models was developed to optimize the components of each cooling system based on the local meteorological and hydrological conditions at the site in accordance with a fixed demand, scalable plant concept. The concept allows one to compare the costs of producing the same net power from each plant/cooling system. ERA

N78-28647# Cornell Univ., Ithaca, N. Y. Coll. of Agriculture and Life Sciences.
ANAEROBIC FERMENTATION OF AGRICULTURAL RESIDUES: POTENTIAL FOR IMPROVEMENT AND IMPLEMENTATION Quarterly and Semiannual Progress Report, 16 Sep. - 15 Dec. 1977

W. J. Jewell, R. W. Guest, R. C. Loehr, D. R. Price, W. W. Gunkel, and P. J. VanSoest 1977 45 p
(EY-76-S-02-2981)
(COO-2981-6; QR-6; SAPR-3) Avail: NTIS HC A03/MF A01

The development of new and/or improved technology to facilitate and promote the widespread use of anaerobic fermentation in agriculture as a source of renewable, clean energy is outlined. Activities reported include: completion of the final draft of the final report describing the findings of the first year of the project; excavation and site preparation; construction of the full scale plug flow and pilot scale random mixed fermentors; installation of the ram pump manure delivery system; construction of two buildings to house controls and appurtenances; and continued operation of the pilot scale plug flow fermentor. ERA

N78-28648# Illinois Univ., Urbana. Dept. of Civil Engineering.

BIOLOGICAL CONVERSION OF BIOMASS TO METHANE Quarterly Progress Report, 1 Jun. - 30 Sep. 1977

J. T. Pfeffer Oct. 1977 29 p
(Contract EY-76-S-02-2917)
(COO-2917-6) Avail: NTIS HC A03/MF A01

Work on the use of beef feed lot manure for the production of methane was studied. Additional data were collected on the operation of the fermentors at thermophilic temperatures. Data were also collected at the mesophilic temperature. A considerable effort was expended on characterizing the reactor effluent and evaluating the dewatering characteristics of the reactor slurry. Evaluation of the type of reactor on methane yields were continued. Data were collected on these systems operating at a total retention time of 10 days. Response of the system and reaction rates were determined. ERA

N78-28649# Los Alamos Scientific Lab., N. Mex.

ELECTRICITY GENERATION AND STORAGE FOR RESIDENCES USING Li/I2 ELECTROCHEMICAL ENGINES TO AUGMENT PHOTOVOLTAICS

G. R. B. Elliot 1977 9 p Presented at Electrochem. Soc. Meeting, Atlanta, 9-15 Oct. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2330; Conf-771060) Avail: NTIS HC A02/MF A01

Electrochemical engines use electrochemical cell reactions and a temperature gradient to convert heat directly to electric power. Such engines can both generate electricity and store electric energy. Application of such engines as used with solar photovoltaic conversion is discussed. Specifically, it is shown that such engines could both store electric energy generated in daytime for nighttime use, and generate electric power from gas or other fossil heat in bad weather. If the photovoltaics remain expensive, the electrochemical engines themselves could be used to generate electric power from focused solar collection. ERA

N78-28650# Sandia Labs., Albuquerque, N. Mex. Safety Engineering and Health Div. 3442.

SOLAR ENERGY RESEARCH AT SANDIA LABORATORIES AND ITS EFFECTS ON HEALTH AND SAFETY

Lawrence L. Young, III 1977 39 p refs Presented at Natl. Safety Congr., Chicago, 18 Oct. 1977
(Contract EY-76-C-04-0789)
(SAND-77-1412; Conf-771067-2) Avail: NTIS HC A03/MF A01

Various solar energy research and development projects at Sandia Laboratories are discussed with emphasis on the primary health and safety hazard associated with solar concentration systems. This limiting hazard is chorioretinal damage. The unique safety and health hazards associated with solar energy collector and receiver systems cannot be measured yet, but progress is being made rapidly. Research is continuing, especially for eye hazards, with more extensive work planned. ERA

N78-28651# California Univ., Berkeley. Lawrence Berkeley Lab. Solar Energy Group.

CALIFORNIA SOLAR DATA MANUAL

Paul Berdahl, Donald Grether, Marlo Martin, and Michael Wahlig Jan. 1978 323 p refs Sponsored in part by the California Energy Resources Conservation and Development Commission, Sacramento, Calif.
(Contract W-7405-eng-48)
(LBL-5971) Avail: NTIS HC A14/MF A01

Factors that determined the data contents of the manual are presented. Estimates of errors in the data were provided, and the impact of these errors on solar design is discussed. The state is divided into 15 solar zones of roughly similar solar radiation conditions, which were illustrated along with page references to the most relevant solar and climate data. A guide to the data tables and graphs was included which were displayed under solar, climate, and sky charts. A guide was given to simplified design methods to predict performance and cost of solar heating and cooling systems. Author (ERA)

N78-28652# California Univ., Livermore. Lawrence Livermore Lab. Technology Applications Group.

DEPARTMENT OF ENERGY'S SOLAR TECHNOLOGY TRANSFER PROGRAM

C. F. Miller 9 Jan. 1978 5 p Presented at the 2d Natl. Conf. and Exhibition on Technol. for Energy Conserv., Albuquerque, New Mex., 24-27 Jan. 1978
(Contract W-7405-eng-48)
(UCRL-80431; Conf-780109-2) Avail: NTIS HC A02/MF A01

Outreach activities were conducted in approximately 30 states. Primary target audiences include such groups as architects, builders, lenders, contractors, plumbers, manufacturers, distributors as well as educational institutions, state and local offices, and library systems. The outreach program is the only operational regionalized solar commercialization capability available to DOE on a nationwide basis at this time. ERA

N78-28653# Bechtel Corp., San Francisco, Calif.

TECHNICAL AND ECONOMIC ASSESSMENT OF SOLAR DISTILLATION FOR LARGE SCALE PRODUCTION OF FRESH WATER Final Report

Dec. 1977 81 p refs
(Contract EY-76-C-04-0789)
(SAND-77-8176) Avail: NTIS HC A05/MF A01

An assessment of solar distillation plant performance attainable with presently implementable technology is presented. A review of existing technology provides the basis for selection of the design for a 5 million gallon per day solar distillation plant. The cost of distilled water from this plant is compared with the cost of water from an oil fired distillation plant of the same installed capacity. For present day plant construction and annual fuel escalation rates below 10.5 percent, water obtained from a solar driven distillation plant is more expensive than that obtained from conventional oil driven distillers. ERA

N78-28654# California Univ., Berkeley. Cooperative Extension Service.

GOVERNMENTAL COSTS AND REVENUES ASSOCIATED WITH GEOTHERMAL ENERGY DEVELOPMENT IN IMPERIAL COUNTY

G. Goldman and D. Strong Oct. 1977 80 p refs
(Contract W-7405-eng-48)
(UCRL-13800; Publ-13800) Avail: NTIS HC A05/MF A01

The cost and revenue impacts to local governments of three geothermal energy growth scenarios in Imperial County were estimated. The level of geothermal energy potential for the three development scenarios tested is 2,000, 4,000 and 8,000 MW, enough power to serve 270,000 to 1,000,000 people. The analysis of the three growth scenarios tested indicates that county population would increase by 3, 7 and 19 percent and assessed values would increase by 20, 60, and 165 percent for Alternatives No. 1, No. 2 and No. 3 respectively. Direct and indirect effects would increase new jobs in the county by 1,000, 3,000 and 8,000. Government revenues would tend to exceed public service costs for county and school districts, while city costs would tend to exceed revenues. In each of the alternatives, if county, cities and school districts are grouped together, the revenues exceed costs by an estimated $1,600 per additional person either directly or indrectly related to geothermal energy development in the operational stages. ERA

N78-28655# California Univ., Livermore. Lawrence Livermore Lab.

METHODOLOGY FOR ASSESSING THE POTENTIAL IMPACT ON AIR QUALITY RESULTING FROM GEOTHERMAL RESOURCE DEVELOPMENT IN THE IMPERIAL VALLEY

P. H. Gudiksen, M. C. Axelrod, D. L. Ermak, K. C. Lamson, and R. Lange 17 Oct. 1977 17 p refs Presented at the Intern. Clean Air Conf., Brisbane, Australia, 15-19 May 1978
(Contract W-7405-eng-48)
(UCRL-79388; Conf-780504-1) Avail: NTIS HC A02/MF A01

The installation of a network of air quality stations for characterizing the air quality and atmospheric transport properties in the valley prior to development is discussed. Analyses of geothermal fluids for various gases were performed to evaluate the potential emission rates from future geothermal power plants. The principal pollutant of concern was H2S because of its noxious odor and potential release rate. These estimated source emission rates and the appropriate meteorological measurements were used as input to a three dimensional, atmospheric transport code to estimate the potential changes in air quality that result from various scenarios for development of geothermal power. ERA

N78-28656# California Univ., Livermore. Lawrence Livermore Lab.

FIELD ELECTROCHEMICAL MEASUREMENTS OF CORROSION CHARACTERISTICS OF MATERIALS IN HYPERSALINE GEOTHERMAL BRINE

J. E. Harrar, R. D. McCright, and A. Goldberg 13 Dec. 1977 24 p refs
(Contract W-7405-eng-48)
(UCRL-52376) Avail: NTIS HC A02/MF A01

A flow cell was developed for use in short term testing of the corrosion behavior of materials in approximately 100 C, hypersaline geothermal brine. The apparatus was designed to accommodate commercial (Petrolite) corrosion measurement equipment and conducted experiments on-line. The apparatus also permitted direct readings of corrosion potentials, solution redox potential (E/sub h/), brine flow rate, pH, and temperature. Estimates of general corrosion rates were obtained by the linear polarization resistance technique and from measurements of complete potentiodynamic polarization curves. Twenty-two alloys (with various heat treatments) were tested and readily grouped according to general corrosion resistances in acidified hypersaline (approximately 4 M chloride) brine. Especially promising in regard to corrosion resistance-vs-cost is the series of low Cr-Mo steels. ERA

N78-28657# General Electric Co., Philadelphia, Pa. Space Div.

APPLIED RESEARCH ON ENERGY STORAGE AND CONVERSION FOR PHOTOVOLTAIC AND WIND ENERGY SYSTEMS. VOLUME 3: WIND CONVERSION SYSTEMS WITH ENERGY STORAGE Final Report

27 Sep. 1977 330 p refs Sponsored by DOE
(Grant NSF C-75-22221)
(TID-28287/3) Avail: NTIS HC A15/MF A01

Wind energy conversion systems and their use of energy storage are studied by the assessment of selected candidate storage concepts, and by evaluation of the effects of selected parameters on the attractiveness and worth of energy storage utilization. The scope of the investigations included both utility and non-utility applications. In addition to establishing cost goals for storage, the impact of charging storage from multiple sources, as well as from wind systems alone, was included, along with the effects of wind forecasting and transient smoothing of the wind system output. ERA

N78-28658# Foster-Miller Associates, Inc., Waltham, Mass.

DEVELOPMENT OF A PASSIVE HEATING AND COOLING SYSTEM USING A PUMPED HEAT PIPE Quarterly Technical Progress Report, 6 Sep. 1977 - 30 Nov. 1977

J. T. Dieckmann Dec. 1977 8 p
(Contract EG-77-C-04-4098)
(TID-28188; QTPR) Avail: NTIS HC A02/MF A01

The technical progress in the program versus schedule and budget is summarized. The efforts expended on each task are discussed briefly. Author (ERA)

N78-28659# Ocean Data Systems, Inc., Monterey, Calif.

OTEC THERMAL RESOURCE REPORT FOR WESTERN GULF OF MEXICO

Oct. 1977 68 p refs
(Contract EG-77-C-01-4028)
(TID-27949) Avail: NTIS HC A04/MF A01

Most probable monthly temperature profiles from surface to 1500-meter depths were developed for nine one degree latitude-longitude squares in the Western Gulf of Mexico for ocean thermal energy conversion (OTEC) purposes. This part of the Gulf of Mexico has no permanent current system. Occasional warm eddies formed by cut-offs from the loop current drift westward through the area, but they are weak with temperature variations of one or two degrees centigrade and currents less than 2 knots. An inventory summary of the temperature observations available in the area is included as well as overall bathymetric information. The monthly temperature data are provided in tabular form and as plots of delta T versus depth for each latitude-longitude square. All soundings and analyses are being delivered to the National Oceanographic Data Center to be maintained in an OTEC file. ERA

N78-28660# Ocean Data Systems, Inc., Monterey, Calif.

OTEC THERMAL RESOURCE REPORT FOR KEY WEST AREA

Oct. 1977 65 p refs
(Contract EG-77-C-01-4028)
(TID-27952) Avail: NTIS HC A04/MF A01

Most probable monthly temperature profiles from surface to 1500-meter depths were developed for eight one-degree latitude-longitude squares in the Key West area for ocean thermal energy conversion purpose. This part of the Gulf of Mexico is the site of a semi-permanent current system. An inventory summary of the temperature observations available is included as well as overall bathymetric information. The monthly temperature data are provided in tabular form and as plots of delta tau versus depth for each latitude-longitude square. A separate annex contains detailed bathymetry, complete data inventories, locator plots of all observations, and results of intermediate analysis. ERA

N78-28661# Los Alamos Scientific Lab., N. Mex.

ECONOMICS OF THE ATTACHED SOLAR GREENHOUSE FOR HOME HEATING

C. D. Kolstad 1978 12 p refs Presented at the 2d Natl. Conf. and Exhibition on Technol. for Energy Conserv., Albuquerque, New Mex., 23-27 Jan. 1978
(Contract EY-76-C-04-0789)
(LA-UR-22; Conf-780109-5) Avail: NTIS HC A02/MF A01

For several years, passive solar heating was considered to be very attractive for home heating in the U.S. Unfortunately passive systems are not as easily analyzed as active systems from an engineering and economic performance point of view. This problem is addressed, and an economic assessment of the solar greenhouse is given. Using simple heat balance analysis, a greenhouse performance model was developed for assessing heat available for home space conditioning from an add on solar greenhouse. This forms the basis for an engineering economic model for assessing the economic viability of the add on solar greenhouse for home heating. Model variables include climate factors, local costs, alternate fuels and system size. The model is then used to examine several locations in the U.S. for the economic attractiveness of the add on solar greenhouse for space heating. ERA

N78-28662# Sandia Labs., Albuquerque, N. Mex.

SOLAR IRRIGATION PROGRAM STATUS

R. H. Braasch and G. E. Brandvold 1978 9 p refs Presented at the Intern. Solar Energy Congr., New Delhi, 16 Jan. 1978
(SAND-78-0398C; Conf-780114-3) Avail: NTIS HC A02/MF A01

A program to develop solar energy as a practical power source for irrigation pumps is discussed briefly. Two experimental systems in operation or under development for developing system designs which are technically and economically feasible are described. One is near Willard, New Mexico, and the other near Coolidge, Arizona. ERA

N78-28663# Sandia Labs., Albuquerque, N. Mex.
THERMOMECHANICAL BEHAVIOR OF POLYVINYL BUTYRAL FILM AND ITS EFFECT ON FOCAL STABILITY OF A SOLAR MIRROR-LAMINATE
A. M. Lindrose and T. R. Guess 1978 17 p refs Presented at the 23d Natl. SAMPE Symp., Anaheim, Calif., 2 May 1978
(Contract EY-76-C-04-0789)
(SAND-77-1850; Conf-780502-2) Avail: NTIS HC A02/MF A01

The thermomechanical behavior of the polyvinyl butyral (PVB) films commonly used in automotive safety glass is reported. The overall objective is to assess the effect of temperature on the focal stability of solar mirror laminates that employ a PVB film interlayer between two sheets of glass. Experimental results presented include both tensile and stress relaxation data on the PVB film over the temperature range -30 to 60 C. Three point blend flexural test data on laminate specimens are also given. Each test set shows the PVB modulus to be highly dependent on temperature. For example, the apparent tensile modulus declines by almost a factor of a thousand, and the mirror laminate flexural modulus of PVB film falls by a factor of four from -30 C to 60 C. In addition, the PVB stress relaxation data, shifted using time-temperature superposition concepts, provide an approximate master relaxation function for estimating arbitrary time and temperature behavior. ERA

N78-28664# Sandia Labs., Albuquerque, N. Mex.
LASER RAY TRACE TESTER FOR PARABOLIC TROUGH SOLAR COLLECTORS
B. D. Hansche Jan. 1978 18 p Presented at the 24th Intern. Instrumentation Symp., Albuquerque, New Mex., 1 May 1978
(Contract EY-76-C-04-0789)
(SAND-78-0012C; Conf-780503-7) Avail: NTIS HC A02/MF A01

A laser ray trace tester is being developed to measure slope errors of parabolic trough solar collectors. The design parameters, current status of the device, and some improvements which are necessary are described. ERA

N78-28665# Sandia Labs., Albuquerque, N. Mex. Systems Analysis Div.
SYSTEMS ANALYSES OF STORAGE IN SPECIFIC SOLAR THERMAL POWER APPLICATIONS
H. M. Dodd 1978 14 p refs Presented at the SERI Storage Applications Workshop, Golden, Colo., 14 Feb. 1978
(Contract EY-76-C-04-0789)
(SAND-78-03424C; Conf-780216-1) Avail: NTIS HC A02/MF A01

Several approaches are presented using optimization techniques plus an additional approach which attempts to discover generalized results concerning the appropriate sizes of solar collector and storage medium for a given load. The optimization techniques either have thermal storage built into the model or (in one case) have a general storage module which can be representative of thermal storage. Applications to solar irrigation and total energy are discussed. Author (ERA)

N78-28666# Illinois Univ., Urbana. Dept. of Civil Engineering.
BIOLOGICAL CONVERSION OF BIOMASS TO METHANE
J. T. Pfeffer Jan. 1978 6 p
(Contract EY-76-S-02-2917)
(COO-2917-7) Avail: NTIS HC A02/MF A01

Complete-mix and multistage reactors are evaluated for use in the anaerobic fermentation of organic solids for methane production. Results indicate that if a balanced population of organisms is maintained in the initial stage, multi-stage fermentation is more efficient than a complete-mix system. However, if the system is stressed, failure of the multi-staged system is more rapid. When the first stage was not inhibited due to a short retention time, the waste stabilization in the additional stages was minimal. Further studies on the effect of retention time on reaction rates indicated that the type of reactor design desired depends upon the objective of the system. A staged system will produce more methane per unit volume of reactor for a given quantity of solid substrate. Maximal methane production per unit volume is obtained by a single-stage reactor operating at near minimum retention. Results of studies on the fermentation of manures and corn stover are discussed briefly. ERA

N78-28667# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazioni.
SOME CONSIDERATIONS ON LONG TERM ENERGY PROSPECTS
G. CamposVenuti, S. Frullani, E. Tabet, and P. Vecchia 7 Nov. 1977 23 p refs In ITALIAN; ENGLISH summary Presented at the Meeting on Energy in the Future, Rome, 9-10 Jul. 1977
(ISS-L-77/11) Avail: NTIS HC A02/MF A01

The different implications of alternative energy sources (nuclear, fusion, and solar) for Italy are discussed from the point of view of environmental problems. Natural limits to the increase of energy production and some energy conservation measures are also considered. Author (ESA)

N78-28668# European Space Agency, Paris (France).
INFLUENCE OF THE EFFECT OF STORAGE MODELS OF POWER CELL DYNAMICS
A. J. Fossard and M. Clique Mar. 1978 27 p refs Transl. into ENGLISH from ESA Journal (Paris), v. 1, no. 3, 1977 p 283-297 Original report in FRENCH previously announced as A78-19486
(ESA-TT-454) Avail: NTIS HC A03/MF A01

A computer model (the injected current method) valid for all types of power cells (buck, boost, buck-boost) in both heavy and light modes of conduction was developed for analyzing switching dc-dc converters. The model is simple and accurate; an essential drawback, however, is that it does not account for the storage effect of the switching transistors. Equations are thus presented augmenting the computer model, taking this storage effect into account; it also analyzes the effect of the input/output filters. The extended model is then valid for the analysis of a wide variety of switching converters functions.
Author (ESA)

N78-28669# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
CONSIDERATIONS ON SOME ECONOMIC AND ENVIRONMENTAL PROBLEMS RELATED TO ENERGY PRODUCTION, PART 1
7 Dec. 1976 47 p In ITALIAN; ENGLISH summary 3 Vol.
(ISS-L-76/15-Pt-1) Avail: NTIS HC A03/MF A01

Origins and significance of the environmental energy and economic crises are discussed, with emphasis on the ecologic, productive, and economic systems. Ecological and thermodynamic fundamentals are presented. Topics dealt with under the theme - the energy sources: fossil combustibles - include petroleum reserves, carbon and synthetic combustibles, environmental dangers, and inflation resulting from the energy problem. ESA

N78-28670# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
CONSIDERATIONS ON SOME ECONOMIC AND ENVIRONMENTAL PROBLEMS RELATED TO ENERGY PRODUCTION, PART 2
14 Dec. 1976 35 p In ITALIAN; ENGLISH summary 3 Vol.
(ISS-L-76/16-Pt-2) Avail: NTIS HC A03/MF A01

Topics dealt with under the theme - energy sources: nuclear and solar energy - include the development of nuclear power in the U.S., the nuclear hazards, the nuclear economy, and the solar alternative, an antidote against the inflation. ESA

N78-28671# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
CONSIDERATIONS ON SOME ECONOMIC AND ENVIRONMENTAL PROBLEMS RELATED TO ENERGY PRODUCTION, PART 3
21 Dec. 1976 43 p In ITALIAN; ENGLISH summary 3 Vol.
(ISS-L-76/17-Pt-3) Avail: NTIS HC A03/MF A01

Environmental and energetic aspects of the transportation system in the U.S. are considered. Topics dealt with under the theme - energy use: the petrochemical industry - include substitution of natural products by synthetic products, environmental and energetic consequences, nondegradable toxic substances

and high energy cost, and the economic origins of petrochemical technology. ESA

N78-28672# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 40, METHODS OF GAS PRODUCTION FOR AMMONIA SYNTHESIS
12 Jul. 1978 85 p refs Transl. into ENGLISH from various Russian documents
(JPRS-71447) Avail: NTIS HC A05/MF A01

The economic advantages of producing ammonia from the gasification of shale are reviewed. The use of natural gas is compared to gasified shale in the ammonia production processes. For individual titles, see N78-28673 through N78-28676.

N78-28673 Joint Publications Research Service, Arlington, Va.
A METHOD OF CONVERTING BALTIC SHALE TO PROCESS GAS FOR AMMONIA SYNTHESIS
Docent Zuhukov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 40, Methods of Gas Production for Ammonia Synthesis (JPRS-71447) 12 Jul. 1978 p 1-26 refs Transl. into ENGLISH from Tr. Leningrad. Inzhenerno-Ekonomicheskogo Inst. (Leningrad), no. 36, 1961 p 76-95 (For primary document see N78-28672 19-44)
Avail: NTIS HC A05/MF A01

The main indices and parameters of the processor of shale conversion were determined on a pilot facility. As calculated per metric ton of absolutely dry process shale, the yield of intermediate products and finished goods was: converted gas - 1150 cu nm, synthesized gas - 1063 cu nm, ammonia and carbon dioxide - 355 and 605 kg respectively, or urea - 612 kg. Synthesized gas was produced by using a steam-air converting mixture, which obviates the need for building and operating an air separation plant. The process was characterized by efficiency for utilizing the material potential of the raw material, exceeding the effectiveness of shale utilization for fuel products by conventional methods by a factor of 2.5. J.A.M.

N78-28674 Joint Publications Research Service, Arlington, Va.
MODERN SCHEMES OF PROCESS GAS PRODUCTION FOR AMMONIA SYNTHESIS
Ye. Ya. Melnikov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 40, Methods of Gas Production for Ammonia Synthesis (JPRS-71447) 12 Jul. 1978 p 28-51 Transl. into ENGLISH from Tr. Leningrad. Inzhenerno-Ekonomicheskogo Inst. (Leningrad), no. 37, 1961 p 76-95 (For primary document see N78-28672 19-44)
Avail: NTIS HC A05/MF A01

Specific investments and the cost of synthetic ammonia are presented. The raw material resources in the nitrogen industry in the U.S.S.R. and noncommunist countries were compared. A diagram of the catalytic steam-oxygen conversion of natural gas under pressure is included. Gas composition during high temperature conversion of natural gas was also examined.
J.A.M.

N78-28675# Joint Publications Research Service, Arlington, Va.
PROSPECTS FOR THE USE OF CHAMBER GAS
A. Ya. Arna and P. R. Lageda *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 40, Methods of Gas Production for Ammonia Synthesis (JPRS-71447) 12 Jul. 1978 p 52-58 refs Transl. into ENGLISH from Tr. Leningrad. Inzhenerno-Ekonomischeskogo Inst. (Leningrad), no. 37, 1961 p 101-106 (For primary document see N78-28672 19-44)
Avail: NTIS HC A05/MF A01

The use of gas from chamber furnaces for ammonia production was found economically more effective than its use as a domestic fuel gas. It will be possible to produce ammonia from chamber gas at practically the same cost as ammonia from natural gas. Ammonia production from gases is described, using the new system of processing shale with a solid heat transfer media or pyrolysis of shale tar with simultaneous production of unsaturated hydrocarbons. The economic effect of the use of chamber gas could be significantly increased by using coke, which is currently dumped. J.A.M.

N78-28676# Joint Publications Research Service, Arlington, Va.
METHODS OF GAS-CHEMICAL NONRESIDUE TREATMENT OF SHALE FOR PRODUCTION OF SYNTHETIC AMMONIA
Reader V. A. Zhukov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 40, Methods of Gas Production for Ammonia Synthesis (JPRS-71447) 12 Jul. 1978 p 59-81 refs Transl. into ENGLISH from Tr. Leningrad. Inzhenerno-Ekonomicheskogo Inst. (Leningrad), no. 37, 1961 p 130-148 (For primary document see N78-28672 19-44)
Avail: NTIS HC A05/MF A01

Test results are discussed for extraction of liquid volatile fractions (tars) during dry distillation in a stream of heat transfer agents. Bituminous coke and gas yields from pyrolysis of tar and gaseous shale products were considered, along with heat and mass balances from producing gas from shale. The consumption coefficients and calculated cost of this gas was aiso studied. J.A.M.

N78-28132*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ENERGY CONSUMPTION PROGRAM: A COMPUTER MODEL SIMULATING ENERGY LOADS IN BUILDINGS
F. W. Stoller, F. L. Lansing, V. W. Chai, and S. Higgins *In its* The Deep Space Network 15 Jun. 1978 p 288-289 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 10B

N78-28503# Leningrad (A. A. Zhdanov) State Univ. (USSR).
RADIATION REGIME OF INCLINED SURFACES
K. Y. Kondratyev and M. P. Fedorova *In* WMO Solar Energy 1977 p 36-61 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28515# Melbourne Univ., Parkville (Australia).
SOLAR RADIATION MODELS FOR USE IN SOLAR ENERGY SYSTEMS SIMULATION
W. W. S. Charters and R. B. Vokach-Brodsky *In* WMO Solar Energy 1977 p 182-190 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28516# Institut Royal Meteorologique de Belgique, Brussels.
COMPUTER PROCEDURE FOR ACCURATE CALCULATION OF RADIATION DATA RELATED TO SOLAR ENERGY UTILIZATION
R. Dogniaux *In* WMO Solar Energy 1977 p 191-197 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28518# World Meteorological Organization, Geneva (Switzerland).
SOLAR ENERGY POTENTIAL IN MOUNTAINOUS TERRAIN
Inge Dirmhirn *In its* Solar Energy 1977 p 211-218 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28519# United Nations Environment Program.
SOLAR ENERGY APPLICATIONS FOR THE ARID AREAS
Bertrand Chatel *In* WMO Solar Energy 1977 p 219-225 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28520# World Meteorological Organization, Geneva (Switzerland).
SOLAR ENERGY RESEARCH AND DEVELOPMENT IN INDIA
A. Ramachandran *In its* Solar Energy 1977 p 226-232 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28521# Bandung Inst. of Technology (Indonesia).
FRAMEWORK FOR A SOLAR ENERGY RESEARCH AND DEVELOPMENT POLICY PROPOSED FOR INDONESIA AND ITS RELEVANCE TO SOLAR ENERGY UTILIZATION IN BUILDING SYSTEMS
Iskandar Danusugondho and Aldy Anwar *In* WMO Solar Energy

1977 p 223-251 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28522# Mali National Solar Energy Lab., Bamaco (West Africa).
DEVELOPMENT AND USE OF SOLAR ENERGY IN MALI
Cheichne Traore *In* WMO Solar Energy 1977 p 252-258 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28523# World Meteorological Organization, Geneva (Switzerland).
A BRIEF REVIEW OF THE UNITED STATES SOLAR RESOURCE ASSESSMENT PROGRAM
Michael R. Riches *In its* Solar Energy 1977 p 259-261 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28524# World Meteorological Organization, Geneva (Switzerland).
NATIONAL SOLAR PROGRAM FOR RESEARCH AND DEVELOPMENT IN ARGENTINA
R. Fernandez, L. Saravia, and W. Scheuer *In its* Solar Energy 1977 p 263-271 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28525# World Meteorological Organization, Geneva (Switzerland).
UTILIZATION OF SOLAR ENERGY IN BRAZIL
Antonio M. A. MacDowell *In its* Solar Energy 1977 p 272-277 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28526# University of the West Indies, Saint Augustine (Trinidad).
SOLAR ENERGY UTILIZATION IN THE WEST INDIES
S. Satcunanathan *In* WMO Solar Energy 1977 p 278-291 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28527# World Meteorological Organization, Geneva (Switzerland).
STATUS OF THE CCMS AND IEA SOLAR ENERGY ACTIVITIES
Frederick H. Morse *In its* Solar Energy 1977 p 292-308 ref (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28528# Pahlavi Univ., Shiraz (Iran). Solar Energy Center.
SOLAR ENERGY UTILIZATION RESEARCH IN IRAN
Mehdi N. Bahadori *In* WMO Solar Energy 1977 p 309-327 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28529# National Research Centre, Cairo (Egypt).
ASPECTS OF SOLAR ENERGY RESEARCH IN EGYPT
I. A. Sakr *In* WMO Solar Energy 1977 p 328-341 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28530# World Meteorological Organization, Geneva (Switzerland).
STATUS OF SOLAR ENERGY PROJECTS IN THE FEDERAL REPUBLIC OF GERMANY
F. J. Friedrich and H. Klein *In its* Solar Energy 1977 p 342-350 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28531# Pahlavi Univ., Shiraz (Iran). Solar Energy Center.
INTERNATIONAL COORDINATION AND PLANNING FOR A MORE EFFECTIVE UTILIZATION OF SOLAR ENERGY
Mehdi Nejad Bahadori *In* WMO Solar Energy 1977 p 351-356 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28532# State Univ. of New York, Albany.
SOLAR ENERGY DEVELOPMENT AND IMPLEMENTATION
Ronald Stewart and Volker A. Mohnen *In* WMO Solar Energy 1977 p 357-371 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28533# World Meteorological Organization, Geneva (Switzerland).
SOLAR HOUSES: A GENERAL APPRAISAL OF SOLAR BUILDING DESIGN AND TECHNOLOGY
C. N. D. Stambolis *In its* Solar Energy 1977 p 372-414 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28534# Copenhagen Univ. (Denmark).
SOLAR HEAT SYSTEMS FOR USE AT HIGH LATITUDES
Bent Soerensen *In* WMO Solar Energy 1977 p 415-421 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28536# Akademiya Nauk URSR, Kiev.
INFLUENCE OF SOLAR RADIATION AND RADIANT HEAT FLOW MEASUREMENT ERROR ON MEASUREMENT ACCURACY OF MATERIAL PHYSICAL CHARACTERISTICS IN SOLAR FURNACES
I. N. Frantsevitch, V. S. Dvernyakov, and V. V. Pasichny *In* WMO Solar Energy 1977 p 431-437 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28537# Centre National d'Etudes Spatiales, Toulouse (France).
INTEGRATION OF INFRA-RED AMBIENT TEMPERATURE AND WIND CONDITIONS IN FLAT COLLECTOR PERFORMANCE PREDICTION
R. Ployart, J. Colomes, and B. Devin *In* WMO Solar Energy 1977 p 438-449 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28538# Building Research Establishment, Watford (England).
SOLAR ENERGY APPLICATIONS IN UK BUILDINGS
R. G. Courtney *In* WMO Solar Energy 1977 p 450-458 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28539# World Meteorological Organization, Geneva (Switzerland).
SOLAR HEATING PERFORMANCE EVALUATION
Dominique Roux, Bernard Tripod, and Jean Robert Mueller *In its* Solar Energy 1977 p 459-468 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28540# World Meteorological Organization, Geneva (Switzerland).
SOLAR ENERGY FOR COOLING: A CHALLENGE TO MODERN TECHNOLOGY
Clifford C. O. Ezeilo *In its* Solar Energy 1977 p 469-478 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28541# World Meteorological Organization, Geneva (Switzerland).
THE ROLE OF SOLAR ENERGY IN SOLAR HEATING, COOLING AND HOT WATER SUPPLY
Tetsuo Noguchi *In its* Solar Energy 1977 p 479-485 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28542# World Meteorological Organization, Geneva (Switzerland).
THE APPROPRIATENESS AND IMPLEMENTATION OF SOLAR ENERGY IN RURAL DEVELOPMENT PROGRAMMES OF DEVELOPING COUNTRIES
W. K. Kennedy *In its* Solar Energy 1977 p 486-497 refs

(For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28543# World Meteorological Organization, Geneva (Switzerland).
DESIGN AND ECONOMY OF SOLAR POWER PLANTS WITH INTEGRATED THERMAL ENERGY STORAGE
P. V. Gilli and G. Beckmann *In its* Solar Energy 1977 p 498-506 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28544# Rome Univ. (Italy).
SOLAR DESALINATION: STATUS AND POTENTIAL
Carlo Mustacchi and Vincenzo Cena *In* WMO Solar Energy 1977 p 507-518 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28545 Centre National d'Etudes Spatiales, Paris (France).
SOLAR ELECTRICITY
W. Palz *In* WMO Solar Energy 1977 p 519-538 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28546# College of Petroleum and Minerals, Dhahran (Saudi Arabia).
DIRECT CONVERSION OF SOLAR ENERGY INTO ELECTRICITY
M. Ali Kettani *In* WMO Solar Energy 1977 p 539-549 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28547# Royal Aircraft Establishment, Farnborough (England).
PERFORMANCE RATING OF PHOTOVOLTAIC SOLAR GENERATORS FOR TERRESTRIAL APPLICATIONS
F. C. Treble *In* WMO Solar Energy 1977 p 550-560 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28548 World Meteorological Organization, Geneva (Switzerland).
PHOTOVOLTAIC CONVERSION OF CONCENTRATED SOLAR RADIATION
K. Krebs and E. Gianoli *In its* Solar Energy 1977 p 561-569 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28549# World Meteorological Organization, Geneva (Switzerland).
STATUS REPORT ON THE DEVELOPMENT OF TERRESTRIAL SOLAR GENERATORS
E. F. Schmidt *In its* Solar Energy 1977 p 570-580 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28550# World Meteorological Organization, Geneva (Switzerland).
PROSPECTS OF POWER GENERATION FROM SOLAR PLANTS IN THE NORTH EAST OF BRAZIL
L. S. Cheema, Cleantho daCamaraTorres, and Pio Caetano Lobo *In its* Solar Energy 1977 p 581-590 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28551# World Meteorological Organization, Geneva (Switzerland).
A CRITICAL STUDY OF THE PHOTOELECTRIC CELL PREPARATION TECHNIQUES
J. Dixmier, M. Rodot, and M. Barbe *In its* Solar Energy 1977 p 591-599 ref (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28552# World Meteorological Organization, Geneva (Switzerland).
SMALL SCALE ELECTRIC POWER GENERATION BY MEANS OF A STATIONARY SPHERICAL REFLECTOR/TRACKING ABSORBER (SRTA) SOLAR COLLECTOR SYSTEM IN DEVELOPING COUNTRIES
F. Kreigh and J. F. Kreider *In its* Solar Energy 1977 p 600-610 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28553# World Meteorological Organization, Geneva (Switzerland).
REALIZATION AND TESTING OF A PUMPING SYSTEM POWERED BY SOLAR CELLS
D. Campana, A. Castiel, A. Perez, J. A. Roger, C. Dupuy, P. Lavit, and M. Lepert *In its* Solar Energy 1977 p 611-620 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28554# World Meteorological Organization, Geneva (Switzerland).
THE THERMODYNAMICS OF SOLAR ENERGY CONVERSION
Gerd Blaesser *In its* Solar Energy 1977 p 622-630 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28555# Wien Univ. (Austria).
PHOTOCHEMICAL HYDROGEN PRODUCTION THROUGH SOLAR RADIATION BY MEANS OF THE MEMBRANE PRINCIPLE
E. Broda *In* WMO Solar Energy 1977 p 631-637 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28556# World Meteorological Organization, Geneva (Switzerland).
INVESTIGATIONS ON SEMICONDUCTOR/ELECTROLYTE SOLAR CELLS AND THE QUESTION OF THE PHOTO-ASSISTED WATER DECOMPOSITION
W. Gissler *In its* Solar Energy 1977 p 638-647 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28557# World Meteorological Organization, Geneva (Switzerland).
THE QUANTITATIVE EVALUATION OF WOOD AS A SOURCE OF SOLAR ENERGY
Waldo E. Smith *In its* Solar Energy 1977 p 648-654 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N78-28677 Stanford Univ., Calif.
ASPECTS OF THE EFFECTS OF PARTICULATE MATTER ON THE ECOLOGY OF A KELP FOREST (MACROCYSTIS PYRIFERA (L.) C. A. AGARDH) NEAR A SMALL DOMESTIC SEWER OUTFALL Ph.D. Thesis
Anthony Morgan Weaver 1978 181 p
Avail: Univ. Microfilms Order No. 78-08862

An investigation of the relation of particulate matter to the ecology of a kelp forest was undertaken near a small sewer outfall located on a flat shale reef in 11 m of water which supported a canopy of the kelp Macrocystis pyrifera. The sewage effluent had an unusually high particulate content which varied several fold through time. The area immediately in front of the outfall terminus, as compared to adjacent stations, was conspicuously more turbid, had higher sedimentation and many patches of exposed shale devoid of organisms, including Macrocystis. The purpose of the study was fourfold: (1) to observe how the quality and quantity of particulate matter fluctuated through time and space; (2) to determine some of the major reasons for these fluctuations; (3) to determine the influence of the quantity and quality of particulate matter on the distribution of benthic organisms; and (4) to determine if and how the sewer outfall influenced particulate matter in the study area. Dissert. Abstr.

N78-28678 Case Western Reserve Univ., Cleveland, Ohio.
STATISTICAL METHODS FOR THE ANALYSIS OF PHOTODYNAMIC BIOASSAY AND INDEXING AIRPOLLUTION TOXICITY Ph.D. Thesis
Ora Bialik 1978 107 p
Avail: Univ. Microfilms Order No. 78-09271

An empirical log-normal dosage-response model describes the photodynamic bioassay of atmospheric organic extracts and their derived fractions, taken from 107 sites in the U.S. The index of relative intensity for the log-normal dosage response model, is suggested as an alternative to the relative potency of a test as compared to a standard. Based on the photodynamic activity of the organic extracts at dosages (g/cu m), and by utilizing a Bayesian approach, critical atmospheric concentrations of the organic extracts are determined. Indices of air toxicity which are based on the photodynamic activity of the individual assays, as well as on their joint activity are given. The indices take into account the type of response curve and the atmospheric concentration of the material assayed. The log-normal model has been tested at all phases of the analysis, showing a high degree of consistency and yielding reasonable results. Practical recommendation for the utilization of the various models are provided. Dissert. Abstr.

N78-28679 Minnesota Univ., Minneapolis.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF DIESEL EXHAUST PARTICULATE MATTER Ph.D. Thesis
Daniel Francis Dolan 1977 190 p
Avail: Univ. Microfilms Order No. 7809650

Particle size distributions in the exhaust of a single cylinder Onan Diesel engine were measured using an Electrical Aerosol Analyzer. These measurements give a volume mean diameter for the exhaust particles of about 0.1 micrometers. Electron microscope analysis of the particles showed a size range of about .05 to .6 micrometers. This analysis showed the existence of both chain and cluster agglomerates. Gravimetric filter analysis showed that the mass collected on the filters was generally higher than that predicted by the EAA at low loads and lower at high loads. Possible reasons for this discrepancy are discussed. A mathematical model for the coagulation of primary smoke particles into the agglomerates seen in the exhaust is presented. It indicates that stratification of the initial particle concentrations within the combustion chamber can explain the observed exhaust particle size distribution. Dissert. Abstr.

N78-28680*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SUBJECTIVE FIELD STUDY OF HELICOPTER BLADE-SLAP NOISE
Clemans A. Powell Jul. 1978 88 p refs Sponsored in part by FAA
(NASA-TM-78758) Avail: NTIS HC A05/MF A01 CSCL 20A

The effects of impulsiveness on the noisiness of helicopters are examined by varying the main rotor speed while maintaining a constant airspeed. This resulted in other characteristics of the noise being held relatively constant. Other controlled variables included altitude, side line distance, descent operations, and level flyovers. A description is provided of the concept, experimental design and procedures along with results based on partial analyses of acoustic and subjective response data. No significant improvement in the noisiness predictive ability of EPNL was provided by either proposed or an A-weighted crest factor correction for impulsiveness. G.G.

N78-28681*# Washington State Univ., Pullman. Air Pollution Research Section.
DETERMINATION OF TRACE GASES IN LEARJET AND U-2 WHOLE AIR SAMPLES COLLECTED DURING THE INTER-TROPICAL CONVERGENCE ZONE STUDY
Dagmar Rais Cronn and Elmer Robinson Aug. 1978 109 p (Grant NsG-7214)
(NASA-CR-157349) Avail: NTIS HC A06/MF A01 CSCL 13B

Whole air samples collected from ground level to 13.7 using a Learjet sampling platform, were analyzed for selected halocarbons, C2 hydrocarbons, N2O and SF6. Low pressure whole air samples collected between 13.7 km and 21.3 km were analyzed for selected halocarbon species and N2O. These tracer compounds were determined in order to study the magnitude of injection of tropospheric air into the stratosphere in the intertropical convergence zone as well as transport processes in the equatorial regions. Sampling methods, analytical methods, and results are discussed. Data tables for all samples analyzed are included. A.R.H.

N78-28682*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMODYNAMIC AND CHEMICAL PARAMETERS OF THE EXHAUST EFFLUENTS FROM THE HARPOON BOOSTER MOTOR
J. Briscoe Stephens and Arnold I. Goldford (Science Applications, Inc., Huntsville, Ala.) Jul. 1978 49 p refs
(NASA-TP-1280; M-257) Avail: NTIS HC A03/MF A01 CSCL 13B

The exhaust products from the Harpoon booster motors were analyzed using both thermodynamic analysis and finite-rate chemistry. The resulting constituents are presented together with a discussion of the techniques employed. G.G.

N78-28683# Health Effects Research Lab., Research Triangle Park, N. C.
SCIENTIFIC AND TECHNICAL ASSESSMENT REPORT ON VANADIUM
Oct. 1977 127 p refs
(PB-278171/4; EPA-600/6-77-002) Avail: NTIS HC A07/MF A01 CSCL 06F

A review and evaluation of the current knowledge of vanadium in the environment as related to possible deleterious effects on human health and welfare are reported. Sources, distribution, measurement, and control technology are also considered. Vanadium is widely distributed in nature and is usually present in small quantities in all media and living forms. The largest source of environmental contamination by vanadium is from oil combustion. Vanadium particulate matter is small, well within the respirable range for human beings. Respiratory absorption of vanadium appears to be very efficient, and it is thought that prolonged, repeated exposure could produce chronic lung disease. GRA

N78-28684# Transportation Systems Center, Cambridge, Mass.
HIGHWAY NOISE MEASUREMENTS FOR VERIFICATION OF PREDICTION MODELS Final Report, Jan. 1975 - Apr. 1976
Edward J. Rickley, David W. Ford, and Robert W. Quinn Jan. 1978 731 p
(PB-279018/6; DOT-TSC-OST-77-30; DOT-TSC-FHWA-77-2; DOT-TSC-OST-78-2; DOT-TSC-FHWA-78-1) Avail: NTIS HC A99/MF A01 CSCL 13B

Accurate prediction of highway noise has been a major problem for state highway departments. Many noise models were proposed to alleviate the problem. Results were used to analyze some of these models, and to determine their accuracy over various areas of the United States. Noise level data for the evaluation were obtained alongside highways and arteries in North Carolina, Florida, Washington, and Colorado. Results include statistical noise data and various other noise indexes for a variety of traffic volumes and speeds, and octave band noise data of individual truck passbys. GRA

N78-28685# Environmental Sciences Research Lab., Research Triangle Park, N.C.
THE OZONE PROBLEM IN THE NORFOLK, VIRGINIA AREA
Gerald A. DeMarrais Jan. 1978 31 p refs
(PB-278997/2; EPA-600/4-78-006) Avail: NTIS HC A03/MF A01 CSCL 13B

The area of Norfolk, Virginia, being well displaced from large urban centers and having the Atlantic Ocean at its eastern border, appears to be sheltered from air pollution originating in other urban sources. The area frequently, however, records high concentrations of ozone. Maximum hourly concentrations exceeded 80 parts per billion in the Hampton Roads area during 40 percent of the days in July and August 1974. The ozone data for that period are analyzed in this report. Emphasis is given to the potential for the high concentrations to have been transported in from distant upwind urban areas. Other meteorologi-

cal phenomena associated with the high concentrations of ozone are also discussed. GRA

N78-28686# National Technical Information Service, Springfield, Va.
ATMOSPHERIC PARTICLE DETECTORS, A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Apr. 1978
Diane M. Cavagnaro Apr. 1978 190 p Supersedes NTIS/PS-77/0360, and NTIS/PS-76/0219
(NTIS/PS-78/0346/3; NTIS/PS-77/0360; NTIS/PS-76/0219) Avail: NTIS HC$28.00/MF$28.00 CSCL 14B

An updated bibliography containing 185 abstracts concerning detectors that are used primarily in air pollution and mine emission applications is presented. Citations include monitoring site selection, applicable instrumentation, and determination of particle concentration. GRA

N78-28687# California Univ., Riverside. Statewide Pollution Research Center.
INTERNATIONAL CONFERENCE ON OXIDANTS, 1976: ANALYSIS OF EVIDENCE AND VIEWPOINTS. PART 7: THE ISSUE OF OXIDANT/OZONE MEASUREMENT Final Report
James N. Pitts, Jr. and George Su Oct. 1977 26 p refs Conf. held Sep. 1976 Prepared in cooperation with Michigan Dept. of Natural Resources, Lansing. Sponsored by EPA
(PB-278903/0; EPA-600/3-77-119) Avail: NTIS HC A03/MF A01 CSCL 04A

Photochemical pollution occurrence and control is reviewed. The issue of oxidant/ozone measurement is discussed. Analytical measurement techniques are compared and recommendations for improvements are made. GRA

N78-28688# Environmental Protection Agency, Ann Arbor, Mich. Emission Control Technology Div.
AUTOMOBILE EXHAUST EMISSION SURVEILLANCE: ANALYSIS OF THE FY 1975 PROGRAM
James A. Rutherford Dec. 1977 177 p refs
(PB-279355/2; EPA-460/3-77-022) Avail: NTIS HC A09/MF A01 CSCL 13B

Through the Office of Air and Waste Management, EPA contracts with several independent laboratories to perform dynamometer emission testing of in-use light duty vehicles. The Emission Factors Testing Program is a continuing project administered by the Emissions Control Technology Division, a part of the Mobile Source Air Pollution Control (MSAPC) program located in Ann Arbor, Michigan. The data is summarized from the fifth year (FY 75) in the series and updates the sample to include 1976 model year vehicles as well as provides continued monitoring of previous model years. State and local agencies, Federal air pollution officials, automobile manufacturers, and concerned citizens can use this summary to estimate the impact of light duty vehicle emissions on air quality and to determine conformity of vehicles to the standards under which they were certified. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N78-28689 California Inst. of Tech., Pasadena.
A HARMONIC AND STATISTICAL ANALYSIS OF THE TOPOGRAPHY OF THE EARTH, MOON, AND MARS Ph.D. Thesis
Bruce Gordon Bills 1978 276 p
Avail: Univ. Microfilms Order No. 78-10779

A global lunar topographic map is derived from earth-based and orbital observations supplemented in areas without data by a linear autocovariance predictor. A series of models of the lunar interior are derived from topographic, gravitational, librational, and seismic data. A model of Martian global topography is obtained by fitting a spherical harmonic series of degree 16 to occultation, radar, spectral and photogrammetric measurements. It is shown that the topographic variance spectra of the Earth, Moon, Mars and Venus are all very similar. Dissert. Abstr.

N78-28690 North Carolina Univ. at Chapel Hill.
FINITE DIFFERENCE WAVE MODELS AND THE DETECTION OF CAVES Ph.D. Thesis
Thomas Daniel Cavanaugh 1977 174 p
Avail: Univ. Microfilms Order No. 78-10429

Seismic surveys above known caves found three different types of anomalies. Cavity oscillation was found over a lava tunnel. New methods were developed for the generation of a plane wave and for the simulation of an explosive source in the finite difference model. A series of models were tested. A comparison was made between 60 m cavities containing air, water, and mud, which showed the anomalies decreased dramatically for the water and mud-filled caves. Two models were developed (a brine cavity and a rubble filled chimney created by an underground nuclear explosion) to represent regions in which seismic profiles were taken above known cavities.
Dissert. Abstr.

N78-28691 Cornell Univ., Ithaca, N. Y.
STUDIES OF THE STATE OF STRESS, MECHANICAL BEHAVIOR, AND DENSITY STRUCTURE OF THE LITHOSPHERE Ph.D. Thesis
William Fulton Haxby 1978 91 p
Avail: Univ. Microfilms Order No. 78-09804

The processes of uplift and erosion of the continents generate large stresses due to the change in overburden pressure, temperature changes, and the effect of vertical movements on a sphere. Variations in erosion rated, which control the temperature, are examined. On a local scale, a source of large stresses is the flexure of the lithosphere. Equations governing the flexure of a spherical shell are derived and solved for different loading geometries. Theoretical deflection curves derived correspond closely with flexural features such as the outer rise of the ocean trenches and the Michigan Basin where a continuous record of subsidence is found in the thickness of successive sedimentary deposits which show the L mechanical lithosphere was thickening during the course of the subsidence. Geoid anomalies over mid-ocean ridges, continental margins, and anomalous sea floor topography are examined and shown to be adequately explained by accepted models of isostatic compensation.
Dissert. Abstr.

N78-28692 California Univ., Los Angeles.
THE DEEP STRUCTURE OF THE UPPER MANTLE FROM THE DISPERSION OF LONG-PERIOD RAYLEIGH WAVES Ph.D. Thesis
Keith Koji Nakanishi 1978 269 p
Avail: Univ. Microfilms Order No. 78-11370

Recordings of fifteen earthquakes are used. From these recordings, sixteen measurements of phase dispersion, to periods as great as 500 sec, on great-circle paths are made. Structure is determined by inverting the phase observations. Different parts of the upper mantle are assigned one of three structural province types based on dispersion of surface waves from previous research. By constraining the shear velocities and densities to be laterally homogeneous in each appropriate layer on a global scale, the depths to the olivine to spinel and the spinel to post spinel phase transitions are determined. The lateral heterogeneity of the upper mantle appears to extend at least as deeply as the spinel/post spinel phase transition. These results indicate a thermal structure in the mantle in which the young continents are cooler than either the average oceans or the ancient shields.
Dissert. Abstr.

N78-28693 Rhode Island Univ., Kingston.
GEOCHEMISTRY OF IGNEOUS ROCKS FROM THE CENTRAL NORTH ATLANTIC: THE AZORES AND THE MID-ATLANTIC RIDGE Ph.D. Thesis
William Michael White 1977 304 p
Avail: Univ. Microfilms Order No. 7811473

A geochemical and petrological study of igneous rocks were carried out in order to investigate the nature of geochemical variations in the region, determine its origin, and investigate the relationship between Mid-Atlantic ridge basalts and lavas from the Azores Islands. Seventy two basalts from the Mid-Atlantic

Ridge between 29 degrees N and 60 degrees N were analyzed for Sr-87/Sr-86, K, Rb, Cs, Sr, and Ba. Thirty five island lavas, two submarine basalts from the Terceira Rift, and four mafic and ultramafic coarse grained inclusions in island lavas were analyzed for Sr-87/Sr-86 major elements, first transition series metals, rare earth elements, K, Rb, Cs, Sr, Ba, Hf, Ta, and Th. A petrographic study and reconnaissance electron microprobe study of mineral phases in island lavas and inclusions were also carried out. Dissert. Abstr.

N78-28694 North Carolina Univ. at Chapel Hill.
THE GEOCHRONOLOGY AND GEOCHEMISTRY OF THE CAROLINA SLATE BELT OF NORTH-CENTRAL NORTH CAROLINA Ph.D. Thesis
William Wesley Black 1977 129 p
Avail: Univ. Microfilms Order No. 7810421

The geochemistry of the volcanic units from several locations in the Carolina state belt indicate that the volcanic units were extruded as a portion of magmatic (volcanic) arc which formed on a continental margin with a thickness of 22 to 37 km of continental crust. The volcanic units in the vicinity of Chapel Hill, N.C., are greater than 705 m.y. in age, while those in the vicinity of Albemarle, N.C., and Lancaster County, S.C., have yielded Cambrian Rb-Sr ages. The chemical pattern of minor and trace elements indicates that the older Chapel Hill area volcanics developed over a thicker section of continental crust and is a high-K tholeiitic sequence characteristic of inner portions of an arc. The younger Albemarle, N.C., area developed as a low-K tholeiitic sequence which is characteristic of the outer portion of an arc. The great age and chemical differences preclude the slate belt being a single arc, but indicate a compound arc. Dissert. Abstr.

N78-28695 Utah Univ., Salt Lake City.
STUDIES IN BASIN AND RANGE VOLCANISM Ph.D. Thesis
Stanley Herbert Evans, Jr. 1978 131 p
Avail: Univ. Microfilms Order No. 78-09960

A suite of silicic volcanic rocks are described, associated with the Roosevelt Hot Springs geothermal area in southwestern Utah. The volcanic sequence included Tertiary rhyolite 8 m.y. old and obsidian, ash, and rhyolite of Quaternary age. The Quaternary lavas were characterized by high silica content (76.5% SiO2) and total alkalies in excess of 9 percent. Obsidians commonly contained greater amounts of fluorine than water. Quaternary alkali-olivine basalt and basanite are also studied which have erupted over 850 sq km in the San Bernardino Valley, Southeastern Arizona. The lava field contained flows, cones of cinder and agglutinate, and several large maars up to 1 km in diameter with associated tuff rings. The lavas contained more alumina and alkalies than typical alkali-olivine basalts; some varieties contain 6.5% Na2O and 3.4% K2O. Dissert. Abstr.

N78-28696 Illinois Univ. at Urbana-Champaign, Urbana.
EXPERIMENTAL EVALUATION OF STABILITY ANALYSIS METHODS FOR SOME ROCK SLOPES BY A PHYSICAL MODEL Ph.D. Thesis
Caner Zanbak 1978 156 p
Avail: Univ. Microfilms Order No. 78-11313

Right angle triangular slabs, 36 in. (91.4 cm) on the side, and cubic blocks, 4 in (10.2 cm) on the side made of a plaster based mixture were utilized to simulate rock. The slabs were used to simulate a ridge wedge or as base planes for a two dimensional model. The blocks were used to create different degrees of kinematic freedom within a nonrigid wedge and in a two-dimensional model. The normal stress level on the wedge planes varied between 0.2 to 5.0 psi (0.01 to 0.36 kg/sq cm.) Failure of model slopes was induced by increasing the dip of the bounding discontinuities by means of specially designed equipment which was capable of providing many orientations to the model slopes. Several types of kinematic restrictions were imposed onto individual orthogonal blocks by selected forms of block stacking to evaluate relative rigidity of the wedges. Test results obtained from such wedges were compared with test results gathered from relatively rigid wedges (monoblock).
Dissert. Abstr.

N78-28697 North Carolina Univ. at Chapel Hill.
SPATIAL AND TEMPORAL RELATIONSHIPS OF EARTHQUAKE ACTIVITY IN THE CIRCUM-CARIBBEAN AND ADJACENT REGIONS Ph.D. Thesis
David Malcolm Best 1977 159 p
Avail: Univ. Microfilms Order No. 78-10420

Analysis of 4,046 earthquakes from the NOAA catalogue covering the period 1965 to 1974 in seven seismic regions in and around the Caribbean reveals that the temporal occurrence of independent seismic activity is generally coincidental. Maximum seismicity occurs at the beginning and end of the time period; minimum activity occurs in 1970 and 1971. Dissert. Abstr.

N78-28698 Wisconsin Univ. - Madison.
HEMISPHERIC DETERMINATIONS OF VERTICAL FLUXES OF ENERGY AND HORIZONTAL MOMENTUM BY GRAVITY WAVES USING FREE FLOATING CONSTANT DENSITY BALLOONS Ph.D. Thesis
William Joseph Massman, Jr. 1978 180 p
Avail: Univ. Microfilms Order No. 78-06437

Data are gathered with a pressure sensor and altimeter carried by free floating, constant density balloons and are of the same order of magnitude as those found in previous investigations using different instruments. A theory of balloon motion is developed, which includes the vertical oscillations of the atmosphere's vertical velocity and the balloon's equilibrium density surfaces, and is the basis for the flux estimates. Since the balloons are near the same level in the atmosphere, the vertical convergence or divergence of the wave fluxes on a global scale are estimated by comparing tropical tropospheric averages with the mid and high latitude stratospheric averages. By this means, the kinetic energy dissipated at the tropopause during times of wave activity is found to be about 14w/m squared 100mb for stationary mountain waves and roughly 1.0w/m squared 100 mb for traveling waves. Evidence is also presented that suggests the jet stream is a source for generating gravity waves. Dissert. Abstr.

N78-28699 Nevada Univ., Reno.
DISLOCATIONS IN VAPOR-GROWN ICE CRYSTALS Ph.D. Thesis
Clyde Vernon McKnight 1977 148 p
Avail: Univ. Microfilms Order No. 78-11018

At all temperatures investigated (-1.5 C, -2 C, -3 C, -5 C and -15 C), X-ray topographs revealed a high degree of perfection in these crystals and several having no emergent dislocations on some prism faces. Heavy dislocation contrast and prismatic loops were found to be associated with nearly all ribs. A plate habit was found to be characteristic of -5 C at 2.5% supersaturation. It was also deduced that when the leading edge of the plate was thin then the prism faces grew by a rough growth mechanism. When this leading edge began to thicken, the linear growth rate of the prism faces was observed to be dependent on plate thickness. The linear growth rate was roughly inversely proportional to the thickness of the face. It was further observed at several temperatures that a low density of emergent screw dislocations on a face would not affect the growth rate of that face. There are indications, however, that high dislocation densities may increase the growth rate. Dissert. Abstr.

N78-28700 Georgia Inst. of Tech., Atlanta.
PLANETARY WAVES IN THE UPPER ATMOSPHERE Ph.D. Thesis
Murray Lewis Salby 1978 218 p
Avail: Univ. Microfilms Order No. 7810821

The problem is pursued for the general frequency range for a barotropic atmosphere in uniform rotation. It is demonstrated that only two vertical modes exist, one being a perturbation of the Lamb mode, and the other attaining large amplitudes in the stratosphere and the mesosphere. A spectrally unbiased technique for decomposing radio meteor wind data into the velocity components is developed. Meteor wind and rawinsonde data are analyzed for spectral content from planetary waves, in particular from the discrete set of normal modes found earlier. The empirical and theoretical results compare favorably and suggest that this low frequency range is composed of essentially discrete spectral content. This discrete nature is present throughout the year in the mesosphere and is most pronounced during winter.

The most consistent features observed, were the two and five-day waves. Dissert. Abstr.

N78-28701 California Univ., Los Angeles.
SOME PROBLEMS OF LOCAL FLOWS IN THE EARTH'S UPPER MANTLE Ph.D. Thesis
David Alexander Yuen 1978 226 p
Avail: Univ. Microfilms Order No. 78-11395

Several geophysically important mantle flows of the local nature, where effects of variable viscosity play a major role, were studied by means of essentially analytical techniques. The potentially destabilizing effects of large velocity gradients in the mantle are also assessed quantitatively. The thermal-mechanical structures of plumes for upwelling from a depth of 400 km in the mantle were calculated. The suboceanic upper mantle was modelled by means of two dimentional boundary layer theory. Temperature and both horizontal and vertical velocity fields were determined. The model also includes the effects of buoyancy and adiabatic cooling. The temporal slip zones were studied and a stability analysis where one dimensional perturbation in both temperature and horizontal velocity fields was conducted.
Dissert. Abstr.

N78-28702 British Library Lending Div., Boston Spa (England).
INFLUENCES OF TEMPERATURE AND PRESSURE ERRORS ON THE DETERMINATION OF THE GEOPOTENTIAL BETWEEN TWO CONSTANT PRESSURE LEVELS AND ON THE HEIGHT OF A SPATIAL BODY IN THE ATMOSPHERE
J. Rieker 5 Jan. 1978 14 p refs Transl. into ENGLISH from Schweiz. Met. Zentralan. Arbeitsber (Switzerland), no. 65, 1976 (BLLD-M-24982-(5828.4F); BLL-Trans-1341) Avail: British Library Lending Div., Boston Spa, Engl.

The introduction into service of an international network of radiosonde stations notably favors the study of the dynamics of the atmosphere. The standard isobaric surface charts give a synaptic view of the atmosphere in a third dimension. They are expressed in geopotential units, of which the trace is fixed by data from stations of the international network. From temperature and pressure measurements made by radiosondes, the height of the pressure levels is calculated with a certain accuracy which depends on the precision of the measurements. Equations are given for calculating the following errors: (1) altitude error of a pressure level; (2) height error of a spatial body in the atmosphere (radiosonde); (3) height error due to temperature. Expressions for interpolation of temperature, height and pressure are also given. G.Y.

N78-28703 British Library Lending Div., Boston Spa (England).
THE ERRORS IN DETERMINING GEOPOTENTIAL AT THE POINTS OF A REGULAR GRID
A. F. Kuzenkov 16 Dec. 1977 11 p refs Transl. into ENGLISH from Tsent. Aerol. Obs. (Moscow), v. 118, 1976 p 17-22 In ENGLISH and RUSSIAN
(BLLD-M-24980-(5828.4F); BLL-Trans-1330) Avail: British Library Lending Div., Boston Spa, Engl.

The practical analysis of meteorological processes deal with situations where the measurements or readings cannot be made at equidistant intervals. Thus, for example, the networks of aerological and meteorological stations are different in density. In making aerological measurements there are sometimes temporal displacements relative to the standard times of observation. However, as a numerical forecast assumes that the initial data are from the points of a regular network at a standard time, ideally the data ought to come from equidistant measurements. It is the objective of this report to estimate the errors in geopotential at the points of a regular network. G.Y.

N78-28704 British Library Lending Div., Boston Spa (England).
PRELIMINARY RESULTS OF THE OPERATIONAL DETERMINATION OF VERTICAL HUMIDITY PROFILES OF THE ATMOSPHERE FROM MEASUREMENTS OF ITS MICROWAVE RADIATION (LAMBDA = 1.35 cm)
A. T. Yershov and V. M. Plechkov 1976 7 p refs Transl. into ENGLISH from Akad. Nauk, Sov. Nats. Kom. Prov. (Moscow), v. 1, 1976 p 351-355
(BLLD-M-24967-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The radio astronomy technique used onboard a Soviet research ship to obtain radio-heat-location measurements during the GARP Atlantic Tropical Experiment is discussed. The potentiality of using the atmospheric attenuation of microwave radiation for determining the different characteristics of atmospheric humidity is examined, and examples are given for determining the specific humidity profiles from meteorological and radiometric data.
A.R.H.

N78-28705*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
REVISED ESTIMATES FOR OZONE REDUCTION BY SHUTTLE OPERATION
A. E. Potter May 1978 48 p refs
(NASA-TM-58209; JSC-13988) Avail: NTIS HC A03/MF A01 CSCL 04A

Previous calculations by five different modeling groups of the effect of space shuttle operations on the ozone layer yielded an estimate of 0.2 percent ozone reduction for the Northern Hemisphere at 60 launches per year. Since these calculations were made, the accepted rate constant for the reaction between hydroperoxyl and nitric oxide to yield hydroxyl and nitrogen dioxide, $HO2 + NO$ yields $OH + NO2$, was revised upward by more than an order of magnitude, with a resultant increase in the predicted ozone reduction for chlorofluoromethanes by a factor of approximately 2. New calculations of the shuttle effect were made with use of the new rate constant data, again by five different modeling groups. The new value of the shuttle effect on the ozone layer was found to be 0.25 percent. The increase resulting from the revised rate constant is considerably less for space shuttle operations than for chlorofluoromethane production, because the new rate constant also increases the calculated rate of downward transport of shuttle exhaust products out of the stratosphere. G.Y.

N78-28706*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Earth and Space Sciences Div.
COMPUTER IMAGE PROCESSING: GEOLOGIC APPLICATIONS
Michael J. Abrams 1 Jun. 1978 36 p refs
(Contract NAS7-100)
(NASA-CR-157347; JPL-Pub-78-34) Avail: NTIS HC A03/MF A01 CSCL 08G

Computer image processing of digital data was performed to support several geological studies. The specific goals were to: (1) relate the mineral content to the spectral reflectance of certain geologic materials, (2) determine the influence of environmental factors, such as atmosphere and vegetation, and (3) improve image processing techniques. For detection of spectral differences related to mineralogy, the technique of band ratioing was found to be the most useful. The influence of atmospheric scattering and methods to correct for the scattering were also studied. Two techniques were used to correct for atmospheric effects: (1) dark object subtraction, (2) normalization of use of ground spectral measurements. Of the two, the first technique proved to be the most successful for removing the effects of atmospheric scattering. A digital mosaic was produced from two side-lapping LANDSAT frames. The advantages were that the same enhancement algorithm can be applied to both frames, and there is no seam where the two images are joined. Author

N78-28707# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
NOCTURNAL AND SEASONAL VARIATION IN THE MESOSPHERIC SODIUM LAYER
Dale M. Simonich, B. R. Clemesha, and V. W. J. H. Kirchhoff Apr. 1978 18 p refs Sponsored in part by Fundo Nacl. de Desenvolvimento Cient. e Technol.
(INPE-1215-PE/121) Avail: NTIS HC A02/MF A01

The vertical profile of mesospheric sodium was measured by laser radar at Sao Jose dos Campos (23 deg S, 46 deg W) on 345 nights since 1972. Very large day to day variations are observed, both in the total abundance of sodium and in its vertical distribution, and only by averaging over a large number of measurements are consistent nocturnal and seasonal trends observed. An annual variation by a factor of two is observed in the total sodium abundance, with maximum in local winter, but no consistent annual variation is observed in the height or

shape of the layer, nor in its nocturnal variation. The average nocturnal variation shows a small decrease in abundance before midnight, followed by a post-midnight increase. The height of maximum sodium concentration decreases throughout the night in all seasons, and the scale height of the topside of the layer increases. Author

N78-28708# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

LASER RADAR MESOSPHERIC TEMPERATURE MEASUREMENTS: PRELIMINARY RESULTS

V. W. J. H. Kirchhoff, B. R. Clemesha, and D. M. Simonich Apr. 1978 15 p refs Sponsored in part by Fundo Nacl. de Desenvolvimento Cient. e Technol.

(INPE-1231-PE/127) Avail: NTIS HC A02/MF A01

Resonant scattering with a laser radar was used to measure the Doppler width of the atmospheric sodium line. By reducing the bandwidth of the laser pulse used for measuring sodium density to about 0.1 pm. the temperature at mesospheric heights can be determined by measuring the width of the sodium D sub 2 line. To accomplish this, the laser wavelength and bandwidth must be sufficiently stable to integrate the return signals over several laser shots. Preliminary measurements were made by introducing an additional Fabry-Perot etalon, of high optical quality, in the laser cavity, to reduce the bandwidth. The small wavelength scan was accomplished by heating the etalon. Returns from 90 Km reproduce the shape of the D sub 2 line, indicating a temperature of about 240 K. A.R.H.

N78-28709# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

INTENSE WAVELIKE OI 6300 A NIGHTGLOW DISTURBANCES AT 22 DEGREES 42' SOUTH, BRAZILIAN ZONE, AS DETECTED BY SCANNING PHOTOMETRIC MEASUREMENTS

Jose H. A. Sobral, M. A. Abdu, and Inez S. Batista May 1978 22 p refs

(INPE-1253-PE/130) Avail: NTIS HC A02/MF A01

Recent data on the OI 6300A nightglow are analyzed. The photometer scanned the meridional zenith angle range of 75 deg north to 75 deg south. Some nights presented remarkable wavelike structures on the OI 6300A meridional profiles. Such wavelike structure occurred essentially during the premidnight periods. These disturbances propagated from north to south at an altitude of 250 km. These airglow disturbances seem to be part of a single periodic wave which originated at lower latitudes. An attempt is made to associate the north traveling atomic oxygen red line enhancements with gravity waves. G.G.

N78-28710# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

PARTICLE IONIZATION IN THE LOWER IONOSPHERE OVER THE SOUTH ATLANTIC GEOMAGNETIC ANOMALY, FROM ROCKET RESULTS DURING THE TOTAL ECLIPSE OF NOVEMBER 1966

M. A. Abdu, Inez S. Batista, and Jose H. A. Sobral 26 May 1978 37 p refs Presented at the Intern. Symp. Comm. on Space Res., Innsbruck, 29 May - 3 Jun. 1978 Sponsored in part by Fundo Nacl. de Desenvolvimento Cient. e Technol.

(INPE-1256-PE/133) Avail: NTIS HC A03/MF A01

Ion composition and electron density data are subjected to a detailed analysis using ion chemistry models for the D and E regions. Equilibrium solutions of the continuity equations are carried out to determine the ion production function that best represents rocket results prior to the eclipse. The ion production rates so derived are then inserted in a time dependent solution of the continuity equations, to predict the ion density profile at the various phases of the eclipse for which rocket observations are available. A comparison is then made of the predicted ion densities and the observations during the totality of the eclipse, to determine the residual ion production rate in the lower ionosphere, due to sources other than solar radiation. This residual ion production source was attributed to the precipitation of charged particles in the South Atlantic geomagnetic anomaly. G.G.

N78-28711# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

CONCERNING THE SEASONAL VARIATION OF THE MESOSPHERIC SODIUM LAYER AT LOW ALTITUDES

B. R. Clemesha, V. W. J. H. Kirchhoff, and D. M. Simonich Jun. 1978 8 p refs Submitted for publication Sponsored in part by Fundo Nacl. de Desenvolvimento Cient. e Technol.

(INPE-1283-PE/139) Avail: NTIS HC A02/MF A01

It is shown that, contrary to a recent claim in the literature, there is a strong seasonal variation in the abundance of atmospheric sodium at 23 degrees S. Author

N78-28712# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

ON THE APPARENT EQUATORWARD PROPAGATION OF AURORAL SUBSTORM ABSORPTION EVENTS AT LOW AURORAL LATITUDES

Syed Ziauddin (Laurential Univ., Sudbury, Ont.) and M. A. Abdu Jul. 1978 20 p refs Submitted for publication Sponsored in part by Fundo Nacl. de Desenvolvimento Cient. e Technol.

(Grant NRC A-3952)

(INPE-1305-PE/148) Avail: NTIS HC A02/MF A01

Auroral substorm absorption events observed at the Val D'Or and Ottawa, Canada stations, located on the lower latitude side of the auroral zone (around L = 4) show a consistent tendency for an apparent equatorward propagation of the events. The observed velocities of propagation do not show any local time dependence or other trends expected from a pure gradient B drift of substorm electrons from the midnight precipitation region to the day side. Though a limited number of events are analysed, the results indicate the possible influence of strong electric fields on the drift velocities of the substorm electrons. Author

N78-28713# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

OH VIBRATIONAL BAND EMISSIONS AND THE EXCITATION MECHANICS IN THE UPPER ATMOSPHERE

H. Takahashi and P. P. Batista Jul. 1978 19 p refs Presented at the 30th Ann. Meeting of Soc. Brasil. para o Progr. da Cienc. Sponsored in part by Fundo Nacl. de Desenvolvimento Cient. e Technol.

(INPE-1306-PE/149) Avail: NTIS HC A02/MF A01

A tilting filter type multi-channel airglow photometer was constructed. Band intensities and rotational temperatures of the six OH band emissions were measured with this photometer. Vibrational population rates and the excitation rates derived from observed band intensities indicate a preferential excitation to the levels v = 8 and v = 9, probably due to the hydrogen-ozone mechanism. Additional excitation mechanisms are considered to explain an increase of the excitation rate in the level v = 5. G.G.

N78-28714# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

GATE UPPER AIR DATA SET PROCESSING PROCEDURES

H. M. T. Nunes, J. A. G. Pereira, and N. J. M. Rao May 1977 76 p refs

(INPE-1022-NTE/085) Avail: NTIS HC A05/MF A01

The techniques used in the processing and validation of the land upper air data set collected by Brazilian participating stations during the GATE experiment are reported. Detailed are the characteristics of the observation stations, the list of quality control tests used, the procedures utilized to obtain the derived parameters, and the format specifications of the magnetic tape containing final data set. G.G.

N78-28715# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SODIUM NIGHTGLOW MEASUREMENTS AND IMPLICATIONS ON THE SODIUM PHOTOCHEMISTRY

V. W. J. H. Kirchhoff, B. R. Clemesha, and D. M. Simonich Apr. 1978 24 p refs Submitted for publication

(INPE-1219-PE/123) Avail: NTIS HC A02/MF A01

Tilting filter photometry recorded over a two year period at (23.2 S) shot that, on the average, the sodium nightglow intensities reach a maximum close to local midnight. Between midnight and dawn the intensity remains fairly constant or increases slightly. The most consistent feature is the pre-midnight decrease in intensity. Seasonal variations show peak intensities at the equinoxes, with the stronger one occurring in autumn. In a few

cases, the nocturnal variation does not follow the average trend, showing rather strong peaks in intensity which have been related to dynamic effects. Based on the photochemistry described the sodium oxide is estimated to vary with season in a similar fashion to mesospheric ozone. The generally accepted rate coefficients for the sodium photochemistry cannot explain the measured intensities. In order to produce results that are consistent with the measurements, model calculations require a coefficient larger by a factor of about 10 for the reaction Na + O3 yields NaO + O2, and for NaO + yields Na* O2 a rate smaller by a factor of 1,000. A.R.H.

N78-28716# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

COMMENTS ON EQUATORIAL F-REGION MOTIONS DEDUCED FROM S SUB q CURRENTS BY TOM BEER

Volker W. J. H. Kirchhoff 31 Oct. 1977 7 p refs Sponsored in part by Fundo Nacl. de Desenvolvimento Cient. e Technol.
(INPE-1155-PE/106) Avail: NTIS HC A02/MF A01

It has been shown (Matsushita, 1968) that the S sub Q current system deduced from geomagnetic variations depends on where the baseline is taken from which the variations are measured. Either the daily mean value or the midnight value have been used as base lines. Calculating F-region motions from the S sub Q currents, in the equatorial region, and comparing the results with F-region drift velocity measurements, Beer (1076) concludes that the daily mean value base line is the one that gives best results. Although this may be true, some statements and conclusions in that paper are misleading and deserve some comments. It is the objective of this paper to correct and comment on the misleading statements and conclusions. G.Y.

N78-28717# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SIMULTANEOUS MEASUREMENTS OF THE OH(8,3) BAND OI 5577 A AIRGLOW EMISSIONS

H. Takahashi, Y. Sahai, B. R. Clemesha, D. M. Simonich, P. P. Batista, and N. R. Teixeira Aug. 1977 25 p refs Submitted for publication. Sponsored in part by Fundo Nacl. de Desenvolvimento Cient. e Technol.
(INPE-1095-PE/072) Avail: NTIS HC A02/MF A01

Simultaneous measurements of the night airglow OH(8,3) band and OI 4477 A Correlations between the nocturnal variations of these emissions and the OH rotational temperature are presented. It was found that OH(8,3) is correlated with the rotational temperature but at a time lag of about 1 hour. The variations of 5577 A lead the OH(8,3) by about 2 to 3 hours. The rotational temperature co-varies with 5577A, rather than with OH(8,3) and there is no significant time lag. Based on this correlation study, the nocturnal variations of the two emissions are explained by the atmospheric density perturbation caused by solar tides and internal gravity waves. G.G.

N78-28718# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

THE MESOSPHERIC SODIUM LAYER AT 23 DEG S: NOCTURNAL AND SEASONAL VARIATIONS

Dale M. Simonich, B. R. Clemesha, and V. W. J. H. Kirchhoff Jul. 1978 42 p refs Sponsored in part by Fundo Nacl. de Desenvolvimento Cient. e Technol.
(INPE-1302-PE/146) Avail: NTIS HC A03/MF A01

The vertical profile of mesospheric sodium was measured by laser on 344 nights since 1972. Large day to day variations were observed but averaging over a large number of measurements consistently shows an annual variation by a factor of two in the sodium abundance, with maximum in local winter. The average nocturnal variation was consistent with photochemical control of the bottomside of the layer and diffusive control of the topside. Variations observed on individual nights appeared to be mainly dynamic in origin. A vertical structure with a characteristic wavelength of the order of 10 km was frequently seen to propagate downwards through the layer at rates between 1 and 4 km hr/1. Comparison of the results with twilight and daytime absorption abundances suggest a latitudinal assymmetry in the seasonal variation of abundance. G.G.

N78-28719# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

EVIDENCE OF AN EXTRATERRESTRIAL SOURCE FOR THE MESOSPHERIC SODIUM LAYER

B. R. Clemesha, V. W. J. H. Kirchhoff, D. M. Simonich, and H. Takahashi May 1978 21 p refs Presented at the Intern. Symp. on Solar-Terrest. Phys., Innsbruck, 29 May - 3 Jun. 1978 Sponsored in part by Fundo. Nacl. de Desenvolvimento Cient. e Technol.
(INPE-1252-PE/129) Avail: NTIS HC A02/MF A01

Lidar observations of the mesospheric sodium layer show three distinct types of organized structure in the vertical distribution of sodium. Profiles averaged over several days showed a smooth but assymmetrical distribution. A sequence of profiles for a given night normally showed a wavelike structure which descended through the layer with time. Very occasionally an extremely narrow peak was observed at a constant height for several hours. On one occasion a layer 2.5 km wide, with scale heights of 700 m on the bottom-side and 900 m on the top-side, was observed to persist at a constant height for three hours. It is concluded that such a layer could neither be produced by neutral density perturbations, nor by photochemical processes, and therefore indicates a source of sodium in the mesosphere. G.G.

N78-28720# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SPECTRA OF THE EXCITED PLASMA LINE IN SPORADIC-E

Ivan Jelinek Kantor Jun. 1978 20 p refs Presented at URSI Gen. Assembly, Helsinki, Jul. 1978 Sponsored in part by Fundo. Nacl. de Desenvolvimento Cient. e Technol.
(INPE-1288-PE/141) Avail: NTIS HC A02/MF A01

A powerful HF radio wave was used to heat the local plasma at the ionospheric height of wave reflection. During a 1976 heating experiment, the plasma line spectrum was observed at the sporadic-E. The spectrum and the conditions of the experiment are presented. The growing mode instability is dominant in the sporadic-E plasma lines. G.G.

N78-28721# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

CORRELATIONS BETWEEN OH NaD AND OI 5577 A EMISSIONS IN THE AIRGLOW

H. Takahashi, P. P. Batista, B. R. Clemesha, D. M. Simonich, and Y. Sahai May 1978 26 p refs Sponsored in part by Fundo Nacl. de Desenvolvimento Cient. e Technol.
(INPE-1255-PE/132) Avail: NTIS HC A03/MF A01

Simultaneous measurements of the night airglow OI 5577A and OH (8,3) band were carried out since 1976. Cross correlation analyses between the nocturnal variations of these emissions and the OH rotational temperature for various time shifts are presented. It is found that OH (8,3) is well correlated with ROT but with a time lag of about 1 hour. The variations of OI 5577A lead OH (8,3) by about 2 to 3 hours. ROT covaries with 5577A, rather than with OH (8,3), with a time lag less than 1 hour. For the sake of comparison, OI 5577A, OH and NaD data from a number of IQSY stations were analyzed. It is noted that OI 5577A leads OH by about 2 hours at middle latitude stations, and that OH is well correlated with Na 5893A with a time lag of less than 1 hour. The presence of the phase lagged correlation patterns between OH/5577A, OH/ROT and OH/NAD indicates vertical propagation of a wave-like perturbation of the upper atmosphere. G.G.

N78-28722# Weidlinger Associates, New York.

TENSILE BEHAVIOR OF GEOLOGICAL MATERIAL IN GROUND SHOCK CALCULATIONS, 2 Topical Report, Jan. - Dec. 1976

Joseph P. Wright Mar. 1977 48 p refs
(Contract DNA001-76-C-0127)
(AD-A053393; AD-E300170; DNA-4450T) Avail: NTIS HC A03/MF A01 CSCL 08/7

As part of a continuing study of material models for ground shock calculations, some aspects of both rate-dependent and rate-independent models for tensile behavior are examined. In particular, the SRI brittle fracture model is studied and compared with a simple tension cut off procedure. For large-scale problems such as those described in this report, it is important to avoid rate-dependent brittle tensile models, if possible, since rate effects appear to be important only on time scales much

smaller than are resolvable in dynamic calculations. On the other hand, rate-independent brittle fracture models are incompatible with current continuum uniqueness-stability theory and hence may not be usable for these problems. It is necessary to examine this situation if tensile modeling techniques are to improve. Some ideas for resolving this conflict are discussed and recommendations for further study are made. GRA

N78-28723# Honeywell Radiation Center, Lexington, Mass.
HIRIS REFLIGHT Final Report, May 1973 - Feb. 1977
Carl Bohne, Lloyd Harkless, and Elton Dunbar 10 Apr. 1977 182 p refs
(Contract DNA001-73-C-0164)
(AD-A053392; AD-E300173; HRC-77-3-3; DNA-HAES-65; DNA-4337F) Avail: NTIS HC A09/MF A01 CSCL 17/5

This report describes the refurbishment and design modification of the cryogenic High Resolution Interferometer Spectrometer (HIRIS), previously developed under Contract DNA 001-72-C-0193, and its successful flight on a rocket probe from Poker Flats, Alaska, on 1 April 1977. A Sergeant booster carried the 900-lb payload to an apogee of 126 km. The HIRIS, operating with an internal temperature near 10 K, obtained 150 spectral scans of aurora, earth, and earth limb between cover opening at 88 km on the upleg and cover closing at 62 km on the downleg. Good signal-to-noise telemetry was received during the flight. Recovery of the payload was successfully accomplished and the HIRIS is in excellent operating condition. Also covered in the report are the feasibility design activities for an improved spatial and spectral performance interferometer and radiometer, and the development of supporting low background calibration equipment. Author (GRA)

N78-28724# General Electric Co., Santa Barbara, Calif.
REACTION RATE DATA, NUMBER 60: RESUME OF FISCAL YEAR DNA-SPONSORED CHEMISTRY/PHYSICS REACTION RATE RESEARCH PROGRAMS
Oct. 1977 11 p
(Contract DNA001-75-C-0023)
(AD-A053677) Avail: NTIS HC A02/MF A01 CSCL 07/4

The following topics are discussed: (1) reaction rates essential to propagation; (2) theoretical investigations of ionizing mechanisms in the upper atmosphere; (3) atomic and molecular physics of IR emissions; and (4) IR phenomenology and optical code data base. GRA

N78-28725# General Electric Co., Santa Barbara, Calif.
REACTION RATE DATA, NUMBER 63: RESUME OF FISCAL YEAR 1978 DNA-SPONSORED CHEMISTRY/PHYSICS REACTION RATE RESEARCH PROGRAMS
Dec. 1977 13 p
(Contract DNA001-75-C-0023)
(AD-A053678) Avail: NTIS HC A13/MF A01 CSCL 07/4

Contents: Reaction Rates Essential to Propagation; Theoretical Investigations of Ionizing Mechanisms in the Upper Atmosphere; Atomic and Molecular Physics of IR Emissions; and IR Phenomenology and Optical Code Data Base. GRA

N78-28726# Ohio State Univ., Columbus. Dept. of Geodetic Science.
ON THE ERRORS OF SPHERICAL HARMONIC DEVELOPMENTS OF GRAVITY AT THE SURFACE OF THE EARTH Interim Report
Lars Sjoeberg Aug. 1977 80 p refs
(Contract F19628-76-C-0010; AF Proj. 7103)
(AD-A052713; DGS-257; AFGL-TR-77-0229; SR-12) Avail: NTIS HC A05/MF A01 CSCL 08/5

The spherical harmonic expansion of the external gravity field of the earth is divergent at the surface of the earth. From the practical point of view a truncated series can be used if the errors are small. The errors are of two types: the truncation error and the downward continuation error. This report investigates the latter, which is caused by the disturbing topography above the point where the series is developed. This error is studied for potentials, gravity anomalies and for the vertical gradient of gravity. It is shown that the usual relation between the spherical harmonics of T and del(Delta (g) del(r) is also valid for their errors, while the relation between T sub n and Delta (g sub n) does not hold for the downward continuation errors. The relative errors of Delta (g) are found to be more serious than those for T. GRA

N78-28727# Texas Instruments, Inc., Dallas. Equipment Group.
EXTRACTION OF LONG-PERIOD BODYWAVES
Stephen S. Lane 14 Nov. 1977 37 p refs
(Contract F08606-77-C-0004; ARPA Order 2551)
(AD-A053602; TI-ALEX(01)-TR-77-07) Avail: NTIS HC A03/MF A01 CSCL 17/10

A polarization filter for long period bodywaves was developed and tested on 100 events from the Kurile Islands and measured at the Guam Seismic Research Observatory. Fifty percent detection thresholds before processing were m sub b = 5.5 and 5.1 for P and S waves, respectively, and were unchanged by the filter unless a substantial false alarm rate was allowed, when the P threshold was reduced to m sub b = 5.0. There is evidence that this poor performance is due to the data set used. Author

N78-28728# Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.
OBSERVED VARIATION IN THE SPECTRAL RATIO DISCRIMINANT FROM SHORT-PERIOD P WAVES
D. H. VonSeggern and R. R. Blanford 19 Sep. 1977 51 p refs
(Contract F08606-77-C-0014; ARPA Order 2551)
(AD-A053527; SDAC-TR-76-12) Avail: NTIS HC A04/MF A01 CSCL 17/10

Short-period P-wave first arrivals recorded at the Large Aperture Seismic Array in Montana from a large number of teleseismic events were filtered in the bands of 0.4-3.0, 0.4-0.8, 1.4-1.8, and 1.8-4.0 Hz. Estimates of signal amplitude in each band were used to form spectral ratios similar to those which have been proposed as discriminants between earthquakes and underground nuclear explosions. Values for the ratios scattered over nearly two orders of magnitude and apparently did not depend on earthquake size or epicentral distance. Average logarithms of spectral ratios for 166 separate geographic regions ranged over one magnitude unit and showed some correlation with known patterns of lateral Q inhomogeneity in the earth, suggesting that attenuation causes much of the spectral ratio scatter. However, attempts to correct LASA m sub b on the basis of observed spectral ratios failed to reduce the scatter in an M sub s -m sub b plot. Variation in stress drops and other physical processes connected with the mechanism of earthquakes must cause as much variability in observed spectral discriminants as variations in attenuation. GRA

N78-28729# Ohio State Univ., Columbus. Dept. of Geodetic Science.
THE ACCURACY OF GRAVIMETRIC DEFLECTIONS OF THE VERTICAL AS DERIVED FROM THE GEM 7 POTENTIAL COEFFICIENTS AND TERRESTRIAL GRAVITY DATA
Lars Sjoeberg Nov. 1977 25 p refs
(Contract F19628-76-C-0010)
(AD-A053234; DGS-265; AFGL-TR-77-0287; SR-13) Avail: NTIS HC A02/MF A01 CSCL 08/5

The deflections of the vertical can be determined with a combined method using point gravity anomalies, mean anomalies and satellite spherical harmonics in the inner-, intermediate- and remote zones, respectively. In essential, the error sources of the intermediate and distant zone are studied. The RMS error contribution of the remote zone was found considerably dependent on the distance of truncation. Another dominating error source is the error due to lack of more detailed gravity data than 1 x 1 deg mean anomalies in intermediate zone. Smaller block sizes are recommended between the distances 1 and 10 deg from the point of computation. A significant gain of accuracy will be achieved in the total error by extending the radius of truncation of at least 30 deg. Anticipating an inner zone error of 1.8 sec (a solution by collocation) the total RMS error will hardly be less than 2.2 sec, while for an inner zone error of 0.4 sec, the total error might decrease to 1.3 sec. Author (GRA)

N78-28730# Photometrics, Inc., Lexington, Mass.
RECORDING AND ANALYSIS OF OPTICAL DATA FROM STRATOSPHERIC DYNAMICS EXPERIMENTS Final Report, 15 Jun. 1976 - 14 Jan. 1978

Christian A. Trowbridge, Irving L. Kofsky, and Ronald H. Johnson
14 Jan. 1978 25 p refs
(Contract F19628-76-C-0239; AF Proj. 6687)
(AD-A054013; PHM-03-78; AFGL-TR-78-0015) Avail: NTIS HC A02/MF A01 CSCL 04/1

A program whose objective is the study of stratospheric winds and temperatures, and mass transport processes in the stratosphere and upper atmosphere, is described. These parameters are determined through reduction and analysis of photographs of sunlight-scattering chemical and smoke (particulate) tracers deposited from rockets. Computer programs implementing triangulation by vector and matrix methods were developed to measure three-dimensional smoke trail positions from multiple photographic projections of the trails. Horizontal winds and shears were derived from the transport of these trails. Author (GRA)

N78-28731# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
PRELIMINARY ANALYSIS OF THE SMALL GRAVITATIONAL ANTENNA DATA [ANALISI PRELIMINARE DEI DATI DELLA PICCOLA ANTENNA GRAVITAZIONALE]
V. Ferrari and G. Pizzella (Rome Univ.) Sep. 1977 17 p refs In ITALIAN
(LPS-77-21) Avail: NTIS HC A02/MF A01

The procedure used to analyze data from the experiment on the detection of short gravitational wave pulses carried out at the Physics Institute of the University of Rome is described. In the experiment a small aluminum antenna (20 kg) operating at 4.2 K was used. It is shown that by means of a suitable algorithm the electronic noise can be reduced to obtain better sensitivity for the detection of possible gravitational signals. ESA

N78-28732# Danish Meteorological Inst., Copenhagen. Ionosphere Lab.
COMPILATION OF IONLAB RIOMETER DATA FOR IMS-WORKSHOP IN HANKASALMI
Peter Stauning and Bjarne Christensen May 1977 47 p
(IONLAB-R-41) Avail: NTIS HC A03/MF A01

Data from riometers located at a net of geophysical observatories in Greenland, Faroe Islands, and North Norway for a number of geophysical events is presented. The tables comprise processed absorption data for some events and photos of raw riometer records for others. ESA

N78-28733# Danish Meteorological Inst., Copenhagen. Ionosphere Lab.
NARSSARSSUAQ RIOMETER DATA, 1 OCTOBER - 31 DECEMBER 1974
Peter Stauning Jun. 1977 34 p
(IONLAB-R-42) Avail: NTIS HC A03/MF A01

Results of riometer measurements at 20 and 30 MHz at Narssarssuaq (Greenland) Geophysical Observatory during October through December 1974 are presented. The data processing and quality are briefly discussed and tables show daily average absorption and measuring time. ESA

N78-28734# Danish Meteorological Inst., Copenhagen. Ionosphere Lab.
NARSSARSSUAQ RIOMETER DATA, 1 JANUARY - 31 MARCH 1975
Peter Stauning Jun. 1977 34 p
(IONLAB-R-43) Avail: NTIS HC A03/MF A01

Results of riometer measurements at 20 and 30 MHz at Narssarssuaq (Greenland) Geophysical Observatory during January through March 1975 are presented. The data processing and quality are briefly discussed and tables show daily average absorption and measuring time. ESA

N78-28735# Danish Meteorological Inst., Copenhagen. Ionosphere Lab.
NARSSARSSUAQ RIOMETER DATA, 1 APRIL - 30 JUNE 1975
Peter Stauning Aug. 1977 34 p
(IONLAB-R-44) Avail: NTIS HC A03/MF A01

Results of riometer measurements at 20 and 30 MHz at Narssarssuaq (Greenland) Geophysical Observatory during April through June 1975 are presented. The data processing and quality are briefly discussed and tables show daily average absorption and measuring time. ESA

N78-28736# Danish Meteorological Inst., Copenhagen. Ionosphere Lab.
NARSSARSSUAQ RIOMETER DATA, 1 JULY - 31 DECEMBER 1975
Peter Stauning Aug. 1977 63 p
(IONLAB-R-45) Avail: NTIS HC A04/MF A01

Results of riometer measurements at 20 and 30 MHz at Narssarssuaq (Greenland) Geophysical Observatory during July through December 1975 are presented. The data processing and quality are briefly discussed and tables show daily average absorption and measuring time. ESA

N78-28737# Danish Meteorological Inst., Copenhagen. Ionosphere Lab.
NARSSARSSUAQ RIOMETER DATA, 1 JANUARY - 30 JUNE 1976
Peter Stauning Aug. 1977 62 p
(IONLAB-R-46) Avail: NTIS HC A04/MF A01

Results of riometer measurements at 20 and 30 MHz at Nassarssuaq (Greenland) Geophysical Observatory during January through June 1976 are presented. The data processing and quality are briefly discussed and tables show daily average absorption and measuring time. ESA

N78-28738# Uppsala Ionospheric Observatory (Sweden).
THE TRANSPARENCY CHARACTERISTICS OF Es TYPES
L. B. Kolawole Sep. 1977 18 p refs Submitted for publication. Sponsored by Swed. Intern. Develop. Authority
(UIO-SR-77-03) Avail: NTIS HC A02/MF A01

The transparency characteristics of different Es types are examined using the blanketing power, fbEs/foEs. This parameter is used to study the structure, seasonal and solar-cycle variations of the different forms of sporadic-E observed over the Northern Hemisphere. The results of the study are compared with those of previous workers who utilized different methods and substantial agreement is observed. While clear evidence of solar-cycle variations were observed in the Es layers at upper temperate and auroral zones, the Es layers at low-latitude and lower temperate regions showed no evidence of solar-cycle variations. Author (ESA)

N78-28535# Genoa Univ. (Italy).
SOLAR ENERGY AND LIMITS TO THE ENERGY ON THE EARTH
G. Francia *In* WMO Solar Energy 1977 p 422-430 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N78-28739 Hawaii Univ., Honolulu.
THE SYNOPTICS AND ENERGETICS OF ATMOSPHERIC CIRCULATION FLUCTUATIONS DURING SUMMER AND WINTER Ph.D. Thesis
Manakkampad S. Unninayar 1977 379 p
Avail: Univ. Microfilms Order No. 7810261

The abnormal mid-season circulation phases were examined in detail, synoptically and energetically. Overall, the circulation fluctuations during summer and winter were found to be extremely complex, with differing circulation systems and regimes interactively coupled with one another. Regional scale climate and circulation fluctuations were found to be intimately related to variations in the large-scale circulation; one of the focal points of this study. An attempt to elucidate as many of the myriad mechanisms and interactive processes as possible within the constraints of data of limited resolution and accuracy was made. Dissert. Abstr.

N78-28740 Arizona Univ., Tucson.
A STUDY OF PHOTOCHEMICAL AEROSOL FORMATION AND THE COAGULATIVE MASS TRANSPORT IN NATURAL AND LABORATORY AEROSOL-GAS MIXTURES Ph.D. Thesis
Richard Adolph Zalabsky 1978 166 p
Avail: Univ. Microfilms Order No. 78-11519

Photochemical Aitken nucleus formation in filtered atmospheric air was examined using both solar irradiation and ultraviolet radiation from artificial sources. Extreme care was taken to insure that nucleus formation is due to trace gases in the air and not to system contaminants and the photochemical experiments have been analyzed in light of measurements of the ambient aerosol size distribution and the associated coagulative mass transport. Attempts to produce nuclei in filtered atmospheric air with radioactive sources of ions have consistently failed.
Dissert. Abstr.

N78-28741 British Library Lending Div., Boston Spa (England).
REPORT OF THE INTERNATIONAL COMPARISON OF ANEMOMETERS (RESOL 17 - CIMO VI - HELSINKI 1973)
G. Lamboley and P. Viton 16 Jan. 1978 26 p Transl. into ENGLISH from report by French Meteorological Service, May 1977 26 p
(BLLD-M-24990-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The behavior of anemometers in strong winds is studied by applying a series of statistical tests and comparison data in such a way as to demonstrate the similarities and differences existing between the various devices. G.G.

N78-28742 British Library Lending Div., Boston Spa (England).
A COMPARISON OF THE FREQUENCIES OF CLEAR AND CLOUDY SKIES OBTAINED FROM SURFACE AND SATELLITE OBSERVATIONS
N. V. Kobysheva 16 Jan. 1978 8 p refs Transl. into ENGLISH from Vses. Nauch.-Issled. Gidromet. Inf. Mirov. Tsent. Danny. (Moscow), v. 42, 1977 p 27-32
(BLLD-M-24989-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Visual information on cloud data in the form of picture sets, mosaics or nephanalysis are collected manually. The cloud cover data were obtained from observations by low-orbit Soviet satellites with a view to transcription. Source material in convenient digital form was obtained for subsequent climatological work to make out recommendations for future automation. G.Y.

N78-28743 British Library Lending Div., Boston Spa (England).
THE EFFECT OF CLOUD COVER ON ATMOSPHERIC RADIATION OVER THE TROPICAL ATLANTIC
B. N. Yegorov 1976 6 p refs Transl. into ENGLISH from Akad. Nauk. Sov. Nats. Kom. Prov. (Moscow), v. 1, 1976 p 594-599
(BLLD-M-24962-(5828.4F); BLL-Trans-1326) Avail: British Library Lending Div., Boston Spa, Engl.

The flux of longwave atmospheric radiation was measured using a radiometer equipped with a germanium filter onboard two Soviet research ships in the tropical Atlantic Ocean. Comparison of data obtained indicate that for one and the same class of cloud cover, the atmospheric radiation betrays no marked differences from night to day. Measured and computed fluxes for six classes of cloud cover and the dispersion of the differences between the two values of E obtained are presented in tabular form. A formula for computing the effective radiation of the sea surface is included. A.R.H.

N78-28744 British Library Lending Div., Boston Spa (England).
A STATISTICAL METHOD OF FORECASTING SURFACE WIND
H. Kruse and J.-O. Struening 1977 17 p refs Transl. into ENGLISH from Met. Rund. (Heidelberg), v. 30, 1977 p 57-62
(BLLD-M-24974-(5828.4F); BLL-Trans-1328) Avail: British Library Lending Div., Boston Spa, Engl.

A statistical technique for objective forecasting of meteorological parameters is used to develop and verify a system of forecasting equations for the prediction of surface wind for six different forecasting periods. The results were compared with persistence - and terminal aerodrome - forecasts and with climatological means. American forecasts were also used for comparison. It is shown that the statistical method of forecasting wind speed is generally better than other methods, while the quality of wind direction forecasts is not significantly different. G.Y.

N78-28745 British Library Lending Div., Boston Spa (England).
MORPHOLOGICAL FEATURES OF CLOUD IN THE EASTERN TROPICAL ATLANTIC
A. M. Borovikov, Ye. V. Lavrentyev, and I. P. Mazin 1976 8 p refs Transl. into ENGLISH from Akad. Nauk, Sov. Nats. Kom. Prov. (Moscow), v. 1, 1976 p 468-473
(BLLD-M-24970-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The international classification of clouds in use at the present time, in terms of their shape or the level at which they are situated, can be used to describe clouds irrespective of their geographic location. However, it was noticed that even morphologically similar clouds which are situated in different climatic zones can differ somewhat from each other both in external appearance and in the height at which they occur. The International Cloud Atlas gives different heights for the clouds of upper, medium, and lower level for three latitudinal zones; polar, temperate and tropical. In particular, upper clouds of the tropical belt are assigned heights of 6-18 km, medium level 2-8 km, and low level 0-2 km. This report supplements and refines existing ideas about clouds in the eastern part of the tropical Atlantic through numerous cloud observations recorded during flights of the GATE aviation programs and during TROPEKS-72. G.Y.

N78-28746 British Library Lending Div., Boston Spa (England).
SOME CHARACTERISTICS OF CLOUD COVER IN THE ITCZ DURING GATE
R. Parrado and A. M. Rodriguez 19 Jun. 1977 6 p refs Transl. into ENGLISH from Akad. Nauk, Sov. Nats. Kom. Prov. PIGAP, Tropeks-74 (Moscow), v. 1, 1976 p 207-213
(BLL-M-24969-(5828.4F); BLL-Trans-1321) Avail: British Library Lending Div., Boston Spa, Engl.

The mean monthly position of the axis and the width of the cloud cover in the convergent zone were determined from daily cloud photographs from the ESSA-8, NOAA-2, and NOAA-3 satellites and from surface synoptic charts from a Soviet research ship in the Atlantic Ocean. The cloud systems of the tropical convergence zone were, on the average, somewhat to the south of the climatological position. The evolution of the tropical convergence zone and the convective activity in it depend directly on the evolution of subtropical anticyclones in the Northern Hemisphere. A.R.H.

N78-28747 British Library Lending Div., Boston Spa (England).
ON THE DESIGN OF A METEOROLOGICAL RADIOSONDE OF THE TRANSISTOR TYPE
Kh. N. Gainanov, Yu. V. Zneiman, B. A. Panchenko, and E. M. Plotnikov 16 Dec. 1977 16 p refs Transl. into ENGLISH from Tsent. Aerol. Obs., Tr. Vyp., (Moscow), 117, 1976 p 151-161
(BLLD-M-24975-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Theoretical aspects of the radiosonde are discussed, and the results of the test program are presented. The commutator, high frequency generator, oscillator, and antenna are described. The results indicate that an acceptable, light weight meteorological radiosonde can be constructed from commercial transistors.
F.O.S.

N78-28748*# National Weather Service, Camp Springs, Md.
SYNOPTIC ANALYSES, 5-, 2-, AND 0.4-MILLIBAR SURFACES FOR JULY 1974 THROUGH JUNE 1976
Jun. 1978 330 p refs
(NASA Order P-55946-G)
(NASA-RP-1023) Avail: NTIS HC A15/MF A01 CSCL 04B

Meteorological rocketsonde and satellite radiance data were employed for analyses of a continuing series of high altitude constant pressure charts. The methods of processing, the various types of data utilized and the analysis procedure are described. Broad-scale analyses of temperature and geopotential height for the Northern Hemisphere 5, 2, and 0.4 mb surfaces are presented for each week of the period July 1974 through June 1976.

Brief discussions of the variations of the temperature and height fields throughout the two year period are also given. G.Y.

N78-28749# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AIR-SEA INTERACTION STUDIES AT CABO-FRIO, BRAZIL
Nandamudi JaganMohanaRao, A. S. Mascarenhas, Jr., and Yoshihiro Yamazaki Aug. 1977 19 p refs Submitted for publication Sponsored in part by Fundo Nacl. de Desenvolvimento Cient. e Tecnol.
(INPE-1105-PE/079) Avail: NTIS HC A02/MF A01

Observed sea surface meteorological parameters are used in the transfer formulas to compute the main heat exchange co-efficients, the sensible heat exchange and the latent heat exchange, also the values of eddy shearing stress of the wind on the sea surface, Bowen's ratio and dissipation of kinectic energy are computed. The computations involved are for the periods July 2 to July 10, 1969, and September 9 to September 21, 1972, at station Cabo Frio occupied by the Naval Ship R/V Almirante Saldanha, which took regular observations at three hourly intervals. The variations in the computed values are studied, in relation to surface synoptic situations, and the results are presented, especially the effect of the presence and displacement of Tropical Maritime Anticyclone. Author

N78-28750# National Oceanic and Atmospheric Administration, Washington, D. C. Center for Experiment Design and Data Analysis.
GATE CONVECTION SUBPROGRAM DATA CENTER: REPORT ON SHIP SURFACE DATA VALIDATION Final Report
Ward R. Seguin, Raymond B. Crayton, Paul Sabol, and John W. Carlile Jan. 1978 81 p
(PB-279560/7; NOAA-TR-EDS-25; NOAA-78021305) Avail: NTIS HC A05/MF A01 CSCL 04B

The results of validation of the surface meteorological data collected by the ships in the A/B-, B-, and C-scale arrays during the 1974 GARP Atlantic Tropical Experiment (GATE) are described. Mean meteorological fields for each of the three GATE observation Phases were analyzed in order to determine the average biases in the measurement of each variable on each ship. Charts of resulting mean values and tabulations of the biases are presented. Included also are updates and corrections to earlier reports issued as part of the GATE Convection Subprogram Data Center, and documentation pertaining to the archived data. GRA

N78-28751# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data Service.
MARINERS WEATHER LOG, VOLUME 22, NUMBER 1. JANUARY 1978
Elwyn E. Wilson Jan. 1978 71 p
(PB-279561/5; NOAA-78021301-Vol-22-No-1) Avail: NTIS HC A04/MF A01 CSCL 04B

In addition to its regular sections this issue contains the following articles: Hurricane Anita - a new era in airborne research; Utilization of offshore currents for improved ship efficiency; An example of shipboard air temperature errors; and Commstation Portsmouth. GRA

N78-28752# Stanford Research Inst., Menlo Park, Calif.
APPLICATION OF THE SRI AUTOMATIC CLOUD-TRACKING SYSTEM TO SMS-GOES DATA Interim Report, 15 Jan. 1976 - 15 Feb. 1977
Daniel E. Wolf, David J. Hall, and Roy M. Endlich 30 Mar. 1977 54 p refs
(Contract N00228-76-C-3067)
(AD-A053619) Avail: NTIS HC A04/MF A01 CSCL 04/2

The SRI automatic cloud-tracking system is being implemented at the present time on the SPADS minicomputer system of the Naval Environmental Prediction Research Facility at Monterey. This report gives background information concerning the system and describes recent improvements. The clustering process, which identifies groups potentially suitable for tracking, has been simplified and improved using a new algorithm for touching groups. Also, the criteria have been made more accurate for pairing groups at two different times to determine cloud displacements. Some current tests of the method (carried out at SRI using a CDC-6400 computer) are described. These tests used SMS-GOES data in both visible and infrared channels for several different types of clouds. In terms of the accuracy and number of cloud-motion vectors obtained, the results are considerably superior to any achieved previously using automatic methods. Our experience indicates that the system can process satellite data routinely to obtain cloud-motion vectors for input to numerical weather-prediction models. Author (GRA)

N78-28753# Istituto di Fisica Dell Atmosfera, Rome (Italy). Ist. di Fisica dell'Atmosfera.
THE MICROMETEOROLOGY BASE SAN PIETRO CAPO FIUME (PO VALLEY - ITALY) [LA BASE MICROMETEOROLOGICA DI SAN PIETRO CAPOFIUME (VALLE PADANA - ITALIA)]
M. Severini Oct. 1977 41 p refs In ITALIAN; ENGLISH summary
(IFA-IN-12) Avail: NTIS HC A03/MF A01

The planning and realization of the micrometeorology base at San Pietro Capofiume for research and applied research in agrometeorology and environmental physics are described. The factors that make the station suitable for the field study of the atmospheric boundary layer in stable conditions are analyzed. The environmental topography suggests the application of the exponential wind profile theory in a horizontally stratified atmosphere. Territory planning near the station is presented in order to stimulate the reader to provide new contributions to the more general problem of the relations between the microclimate and the environment. ESA

N78-28754# Royal Netherlands Meteorological Inst., De Bilt.
A BAROTROPIC MODEL FOR 96-HOURS CIRCULATION EXPECTATIONS [EEN BAROTROOP MODEL VOOR 96-UURS CIRCULATIEVERWACHTINGEN]
J. D. Opsteegh 1977 30 p refs In DUTCH
(KNMI-V-295) Avail: NTIS HC A03/MF A01

The operational computer program of the barocline three-layer model was used as a starting point for the development of a new barotropic program for 96 hour circulation predictions. The barotropic model is described; the difference schemes used are dealt with. The computer program is described in detail and the complete listing is given. ESA

N78-28755# Royal Netherlands Meteorological Inst., De Bilt.
THE EVAPORATION FROM A CLAYLAND GRASS SURFACE IN THE SUMMER OF 1976 COMPARED WITH THE PENMAN FORMULA [DE VERDAMPING UIT GRAS OP KLEIGROND IN DE ZOMER VAN 1976 VERGELEKEN MET DE PENMAN-FORMULE]
H. A. R. deBruin and W. Kohsiek 1977 26 p refs In DUTCH; ENGLISH summary
(KNMI-WR-77-10) Avail: NTIS HC A03/MF A01

Measurements of daily evaporation from a grass surface with the energy balance method using the Bowen ratio are described. These are compared with the daily potential evaporation, calculated with the empirical method of Penman: E(pot) = f E sub o, where f is a factor depending on the month and E sub o is the evaporation of a hypothetical open water surface, exposed to the meteorological conditions of the site under consideration. The ratio E(EB)/E(pot) qualitatively agreed with the observed time pattern of rainfall and soil moisture (the latter measured with a neutron-probe). The evaporation experiments form part of a research program on the structure of the boundary layer of the atmosphere. For this program a 200 m high tower was installed and equipped with instruments for sensing wind speed and direction, temperature, humidity, etc. Author (ESA)

N78-28756# Royal Netherlands Meteorological Inst., De Bilt.
THE RELATION BETWEEN ANOMALIES IN THE NORTH ATLANTIC OCEAN TEMPERATURE AND THE MONTHLY MEAN TEMPERATURE AT DE BILT AND THE USEFULNESS OF THIS RELATION FOR FORECASTING THE MONTHLY MEAN TEMPERATURE [HET VERBAND TUSSEN ANOMALIEEN IN DE TEMPERATUUR VAN DE NOORDATLANTISCHE OCEAAN EN DE MAANDGEMIDDELDE TEMPERATUUR IN DE BILT EN DE BRUIKBAARHEID HIERVAN VOOR DE MAANDVERWACHTING]
J. Oerlemans 1977 19 p refs In DUTCH; ENGLISH summary

(KNMI-WR-77-11) Avail: NTIS HC A02/MF A01

The results of an empirical study on the relations between North Atlantic sea-surface temperature anomalies (STA's) and the monthly mean air temperature at De Bilt (Tm) are presented. Special attention is paid to the effect of various timelags, both positive and negative, between those quantities. The study was based on the STA classification of Ratcliffe, covering the period 1877 to 1975. The use of STA's in forecasting monthly mean temperature is discussed briefly. The main results are: (1) there have been clear tendencies in the occurrence of the various STA types during the period 1877 to 1975. (2) STA-Tm relations do exist, most apparently in winter. (3) The timelag dependency of the correlations suggests the presence of interactive mechanisms between STA's and atmospheric circulation on a large time-scale (at least 6 months). (4) Tested on independent material (77 months), forecasting rules for Tm based on STA's appeared to give a useful skill (about 13% better than climatological forecasts). Author (ESA)

N78-28757# Royal Netherlands Meteorological Inst., De Bilt.
DESIGN OF A BAROCLINIC THREE-LEVEL QUASI-GEOSTROPHIC MODEL WITH SPECIAL EMPHASIS ON DEVELOPING SHORT FRONTAL WAVES
L. C. Heijboer 1977 156 p refs
(KNMI-102-98) Avail: NTIS HC A08/MF A01; Roy. Neth. Meteorol. Inst. DFI 49

The design of a three-level quasi-geostrophic model suitable for short range weather predictions up to 36 hours ahead is discussed. A theoretical investigation indicates that long waves show an equivalent barotropic behavior and that short frontal waves are really baroclinic, showing a phase shift between height and thermal fields. From these results a baroclinic model can be constructed which includes a dry and a moist version which differ with regard to the incorporation of released latent heat.
ESA

N78-28758# Royal Netherlands Meteorological Inst., De Bilt.
YEARBOOK A, NO. 127. METEOROLOGY, 1975 Annual Report - 1975
1977 75 p In ENGLISH and DUTCH
(KNMI-97-127) Avail: NTIS HC A04/MF A01; Roy. Neth. Meteorol. Inst. DFI 17,50

Results of observations made at 46 meteorological stations (including synoptic stations, climatological stations, and light-ships) during 1975 are presented. Tables give daily observations of air pressure, wind direction and velocity, temperature, humidity, vapor pressure, global radiation, sunshine, and precipitation. Summaries are also given of monthly and yearly data. ESA

N78-28759# Royal Netherlands Meteorological Inst., De Bilt.
MARINE CLIMATOLOGICAL SUMMARIES FOR THE MEDITERRANEAN AND SOUTHERN INDIAN OCEAN, VOLUME 1, 1961
1977 540 p
(KNMI-151-1) Avail: NTIS HC A23/MF A01; Roy. Neth. Meteorol. Inst. DFI 25

Results of observations made in eight areas in the Mediterranean Sea and thirteen in the southern Indian Ocean during 1961 are tabulated. Monthly readings are presented for cloud amount, dry-bulb temperature, dew-point temperature, sea-surface temperature, air-sea temperature differences, wind direction and velocity, and atmospheric pressure. ESA

N78-28760# World Meteorological Organization, Geneva (Switzerland).
MANUAL ON THE GLOBAL DATA-PROCESSING SYSTEM. VOLUME 1: GLOBAL ASPECTS
1977 62 p
(WMO-485; ISBN-92-63-10384-9) Avail: NTIS HC A04/MF A01

Volume 1 of the Manual contains both standard and recommended practices and procedures, which are defined. The organization and function of the global data processing system is described in part 1, while parts 2 and 3 deal with data processing for real-time and non real-time users respectively.
ESA

N78-28761# Central Electricity Generating Board, London (England).
TIPPING-VESSEL RECORDING RAINGAUGE
N. A. Liptrot Mar. 1978 9 p
(TDB-292) Avail: NTIS HC A02/MF A01

As part of investigations into the long range drift of sulphur dioxide, rainfall was measured at ten sites. The rainfall was collected weekly when the sulphur dioxide instruments were serviced. The volume of rainwater was measured and a sample of up to 300 ml was brought to the laboratory for analysis of constituents. Commercially obtained clockwork recording rain gages, installed at three of the sites to measure the time and intensity of rainfall, proved unreliable due to faults with the chart drive units and many results were lost. Author (ESA)

N78-28504# World Meteorological Organization, Geneva (Switzerland).
USE OF EXISTING METEOROLOGICAL INFORMATION FOR SOLAR ENERGY APPLICATION
Lars Dahlgren *In its* Solar Energy 1977 p 62-65 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28505# British Columbia Univ., Vancouver.
CLIMATOLOGICALLY RELATED PROBLEMS IN DETERMINING THE POTENTIAL FOR SOLAR ENERGY UTILIZATION IN CANADA
John E. Hay *In* WMO Solar Energy 1977 p 66-79 refs Sponsored in part by Natl. Res. Council of Can. and Can. Atmospheric Environ. Serv. (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-29039# Joint Publications Research Service, Arlington, Va.
ATMOSPHERIC PROCESSES ABOVE THE PACIFIC OCEAN
V. S. Samoylenko *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 74-84 Transl. into ENGLISH from Zemlya Vselennaya (Moscow), no. 3, 1978 p 6-11 (For primary document see N78-29032 19-99)
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48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N78-28762 Rhode Island Univ., Kingston.
THE ISOLATION AND PARTIAL CHARACTERIZATION OF THE DISSOLVED ORGANIC MATTER IN SEA WATER Ph.D. Thesis
Richard Alan Kerr 1977 195 p
Avail: Univ. Microfilms Order No. 78-11467

Dissolved organic matter (DOM) was adsorbed onto activated charcoal and then extracted in three different fractions with a series of solvents. Peformance of the procedure was followed by analysis for dissolved organic carbon (DOC). This procedure recovered about 50% of oceanic DOC, 23-63% of estuarine DOC, and 18-60% of other types of natural DOC. The representativeness of charcoal-isolated organic matter (OM) was determined for several terrigenous humic and humic-like substances by analyses before and after isolation. Variations of about 20% occurred in spectroscopic characteristics and copper associating capacities following isolation. Highly variable recoveries of estuarine DOM and low recoveries of the recently generated DOM in laboratory experiments suggests that a disproportionate portion of DOM in biologically dynamic environments may not be recovered by activated charcoal. Dissert. Abstr.

N78-28763 Rhode Island Univ., Kingston.
STUDIES OF THE SEA TO AIR TRANSPORT OF TRACE METALS IN NARRAGANSETT BAY Ph.D. Thesis
Stephen Romauld Piotrowicz 1977 182 p
Avail: Univ. Microfilms Order No. 78-11470

A device called a Bubble Interfacial Microlayer Sampler (BIMS)

was constructed to investigate, in-situ, the effects of the bubble breaking process at sea on the atmospheric geochemical cycles of the elements Fe, Cu, and Zn. The BIMS creates a miniature environment for the production and collection of atmospheric sea salt particles. Mounted on a catamaran the BIMS was operated in the coastal waters of Narragansett Bay, Rhode Island and the data obtained are related to the global, geochemical cycles of these elements. Dissert. Abstr.

N78-28764 British Library Lending Div., Boston Spa (England).
TIME VARIABILITY OF SURFACE WATER TEMPERATURE IN THE TROPICAL ATLANTIC
V. V. Vinogradov and L. V. Mironov 1976 10 p refs Transl. into ENGLISH from Akad. Nauk, Sov. Nats. Kom. Prov. (Moscow), v. 2, 1976 p 39-45
(BLLD-M-24965-(5828.4F); BLL-Trans-1310) Avail: British Library Lending Div., Boston Spa, Engl.

The hydrometeorological regime of the boundary layer of the Atlantic Ocean in the tropical zone was measured using quick acting thermistors and the infrared radiometer onboard a Soviet scientific research ship. Records of measured values, made in continuous series lasting for 8, 10, and 15 days over a 24 hour period, show that the temperature of the 0-1 cm surface layer of the ocean is subject to large fluctuations in comparison with the temperature as measured by contact apparatus or by routine thermometers of the ship's hydrometeorological station. In tropical conditions, the amplitude of the diurnal variation of temperature according to the readings of the ship's thermometer was 3 to 4 times lower than data from the infrared radiometer. A.R.H.

N78-28765 British Library Lending Div., Boston Spa (England).
THERMAL RADIATIVE FLUX AT THE CENTRE OF THE EQUATORIAL ATLANTIC FROM COMPUTATIONS AND MEASUREMENTS BY THE AKADEMIK KURCHATOV
A. S. Ginzburg 1976 12 p refs Transl. into ENGLISH from Akad. Nauk, Sov. Nats. Kom. Prov. (Moscow), v. 1, 1976 p 577-586
(BLLD-M-24972-(5828.4F); BLL-Trans-1325) Avail: British Library Lending Div., Boston Spa, Engl.

In addition to the night-time measurements required by Soviet ships in the GARP Atlantic Tropical Experiment, the day-time flux of thermal radiation was also recorded. The following parameters were calculated: the integral flux in the band 3 to 100 micron m; the flux of the downward atmospheric radiation (counterradiation) at the lower level of measurement z = 10m -F); the flux of radiation from the sea surface; the effective radiation; the flux of upward radiation; and the radiative cooling of the entire depth of the atmosphere. Measurements used in the calculations include: (1) temperature, humidity and pressure, measured four times every 24 hours up to heights of the order of 30 km, using radiosondes; (2) temperature of the sea surface - hourly meteorological measurements; (3) cloud amount and type - hourly meteorological observations, refined by instrumental measurements; and (4) estimates of cloud base by stereophotogrammetric methods. Computed values are compared with night-time measurements. A.R.H.

N78-28766# Naval Underwater Systems Center, New London, Conn.
THE INVERSE FAST FIELD PROGRAM (IFFP). AN APPLICATION TO THE DETERMINATION OF THE ACOUSTIC PARAMETERS OF THE OCEAN BOTTOM
F. R. DiNapoli 5 Aug. 1977 25 p Presented at the 9th ICA, Madrid, 5 Jul. 1977
(SF5255601)
(AD-A053769; NUSC-TM-771160) Avail: NTIS HC A02/MF A01 CSCL 20/1

The problem of estimating the acoustic field produced by a point source located in an environment which is arbitrarily stratified with depth only has received considerable attention. Various models exist which provide reasonable results provided sufficient information about the environment and source characteristic is available. This paper is concerned with solving for the inverse of this problem, i.e., information about the environment, in particular the impedance at the ocean-bottom interface is sought from a knowledge of the received acoustic field and the source which produced it. The theoretical formulation of the scheme is presented and its numerical implementation is discussed and illustrated for three examples of successive orders of environmental complexity. Author (GRA)

N78-28767# Naval Civil Engineering Lab., Port Hueneme, Calif.
LONG-TERM STRESS-STRAIN BEHAVIOR OF A SEAFLOOR SOIL Final Report, Jul. 1974 - Jun. 1975
P. J. Valent Feb. 1978 57 p
(AD-A053506; CEL-TN-1515) Avail: NTIS HC A04/MF A01 CSCL 08/10

A calcareous deep-sea soil from the central Caribbean was subjected to a series of consolidation, triaxial shear, and triaxial shear creep tests to determine its response to loadings of engineering interest. The soil, classified as an inorganic silt, tended to densify during transport. Compression index C sub c is 0.80; empirical terrestrial engineering correlations between C sub c and other easily and rapidly measured index parameters may be in error by 30%. No significant crushing of the hollow foraminifera tests (shells) comprising the coarse-size fraction of the sediment was noted in the consolidation tests up to stresses of 1,530 kPa (32,000 psf). This coarse-size fraction does, however, undergo significant crushing if material finer than 0.43 mm is removed, suggesting that the fine-sized fraction distributes loads on the coarse-sized test (shell) surfaces. Grain crushing may be partly responsible for the curved failure envelope developed from the triaxial shear tests. For specimens consolidated up to 30 kPa (4 psi) the angle of internal friction for the calcareous ooze is 0.60 rad (34 deg); specimens consolidated to greater pressures describe a flattening of the failure envelope to 0.49 rad (28 deg). Triaxial shear creep tests indicate that creep failure in this soil is not a significant engineering problem. The data suggest that material consolidated to higher stress levels than those used here 100 kPa) and then shear loaded undrained will develop failure strains at stress levels less than 80% of short-term failure stress levels. Author (GRA)

N78-28768# EG and G Washington Analytical Services Center, Inc., Rockville, Md.
AIR DEPLOYED OCEANOGRAPHIC MOORING (ADOM) Progress Report, 1977
Leslie W. Bonde Apr. 1978 104 p refs
(Contract N00014-74-C-0146)
(AD-A053662; EG/G-TR-4618-0002) Avail: NTIS HC A06/MF A01 CSCL 08/10

This report documents the technology accomplishments in the Air Deployed Oceanographic Mooring (ADOM) program during 1977. Open ocean and ice covered ocean mooring systems were investigated. Both systems are configured to measure temperature, conductivity, and pressure. The actions, analyses, and investigations necessary in the continuation of the ADOM Feasibility Study are presented. GRA

N78-28769# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
PRELIMINARY EVALUATION OF WIND AND WAVE EFFECTS AT POTENTIAL LNG TERMINAL SITES, STATE OF CALIFORNIA. APPENDIX A: AN EVALUATION OF THE RELATIVE WAVE CLIMATE AT FIVE ONSHORE LNG SITES CONSIDERING ISLAND INFLUENCES AND TOPOGRAPHIC EFFECTS Final Report
Lyndell E. Hales Apr. 1978 458 p refs
(AD-A054130; WES-MP-H-78-2-App-A) Avail: NTIS HC A20/MF A01 CSCL 13/10

The U. S. Army Engineer Waterways Experiment Station (WES) was requested to assist in the preliminary evaluation of the wave climate at alternate potential LNG terminal sites by applying existing hindcast wave data of a general nature to obtain estimates of the times of excessive wave conditions at the various sites. After the preliminary evaluation was completed, WES was again requested to assist by analyzing the effects of island sheltering and topographic influences on the wave climate of five onshore sites in order to provide a more refined estimate of the wave conditions existing at the potential sites. The deepwater hindcast wave data used in the evaluation were the State of California Department of Navigation and Ocean Development (DNOD) singular wave statistics, and supplemental hindcast data by National Marine Consultants (NMC) and Marine Advisers (MA). GRA

N78-28770# Royal Netherlands Meteorological Inst., De Bilt.
METEOROLOGICAL EFFECTS ON TIDAL HEIGHTS IN THE NORTH SEA
H. Timmerman 1977 103 p refs
(KNMI-102-99) Avail: NTIS HC A06/MF A01; Roy. Neth. Meteorol. Inst. DFI 45

The parameters (wind, atmospheric pressure gradients, astronomical forces) causing variations in the height of the sea-level in the North Sea, particularly around Dutch coastal regions, are first discussed and statistical and physical investigations of the influence of meteorological forces on the sea are reviewed. A method for the computation of the deviation of water levels, related to the hydrodynamic equations, is discussed with applications. ESA

N78-28771# Royal Netherlands Meteorological Inst., De Bilt.
SEA WAVES [ZEEGOLVEN]
P. Groen and R. Dorrestein 1976 133 p refs In DUTCH
(KNMI-111-11) Avail: NTIS HC A07/MF A01

Sea waves, the energy of which is generated by the wind, are considered. Theoretical background of the generation of water waves is discussed based on hydrodynamic theory. The development of wind waves and swell is described. The deformation and annihilation of waves by coastal effects is detailed. Some observation methods and results are outlined. ESA

N78-29040# Joint Publications Research Service, Arlington, Va.
GEOMORPHOLOGY AND TECTONICS OF THE PACIFIC OCEAN FLOOR
G. P. Udintsev *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 85-93 Transl. into ENGLISH from Zemlya Vselennaya (Moscow), no. 3, 1978 p 12-17 (For primary document see N78-29032 19-99)
Copyright. Avail: NTIS HC A06/MF A01

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N78-28772 Oklahoma State Univ., Stillwater.
PORCINE MALIGNANT HYPERTHERMIA: STUDIES ON ISOLATED MUSCLE STRIPS Ph.D. Thesis
Ian Laurence Anderson 1977 104 p
Avail: Univ. Microfilms Order No. 78-11025

The effects and interactions of halothane and caffeine are investigated. Also the antagonistic effects of dantrolene sodium on halothane and caffeine induced twitch tension and contracture responses are examined. Halothane induced marked contractures in muscle from malignant hyperthermia susceptible swine which was also more sensitive to caffeine induced contractures than normal porcine muscle. Halothane potentiated twitch tension responses in both normal and malignant hyperthermia muscle and exaggerated the delayed relaxation phase of twitch response especially in malignant hyperthermia muscle. Dantrolene sodium elevated the rheobase of malignant hyperthermia muscle fibers strength duration curve for mechanical threshold, reversed and prevented halothane potentiation of twitch tension in normal and malignant hyperthermia muscle, but had no effect on halothane induced twitch relaxation delay. Dantrolene sodium also prevented and reversed halothane induced contractures in malignant hyperthermia muscle and significantly attenuated caffeine induced contractures in normal and malignant hyperthermia porcine muscle. Dissert. Abstr.

N78-28773 North Dakota Univ., Grand Forks.
AN ANALYSIS OF NEUROMUSCULAR FUNCTION AT HYPERBARIC PRESSURES Ph.D. Thesis
George Richard Athey 1977 99 p
Avail: Univ. Microfilms Order No. 78-10310

The frog sciatic nerve-gastrocnemius muscle preparation was chosen as the classical synaptic modeling system for this study. The nerve-muscle preparation was placed in a Plexiglas bath supplied with electrodes for stimulation and recording. This Plexiglas chamber was placed in a hyperbaric pressure vessel connected by way of electrical throughputs and shielded cable to dual beam oscilloscope for display of nerve and muscle compound action potentials which were then photographed for analysis. Pressurization to 1,000 psig (69.5 ATA) with helium was accomplished at a rate of 100 psig per minute. The first series of experiments was designed to investigate the effects of pressure upon nerve-muscle functioning. The second series of experiments investigated the effects of pressure upon the action of tetraethylammonium chloride. The final series of experiments considered the effects of pressure upon neostigmine bromide. Dissert. Abstr.

N78-28774 California Univ., Los Angeles.
HYPOXIC CONDITIONING IN KITTENS: SLEEP-WAKING STATE AND CARDIORESPIRATORY RESPONSES Ph.D. Thesis
Theodore Leslie Baker 1978 169 p
Avail: Univ. Microfilms Order No. 78-11332

The effects of long term intermittent hypoxia were studied in 10, 20 and 40 day old kittens. Hypoxic conditioning was accomplished by placing kittens in chambers with controlled oxygen atmospheres (21%, 10% or 7% O2) for four hours daily, for either three or eight days. During the conditioning sessions. Each minute of data was manually and computer analyzed. Manual analysis included determination of the sleep-waking state (waking, active sleep, quiet sleep, or mixed), identification of the frequency and characteristics of apneas, and general evaluation of cardiorespiratory responses to hypoxia. Computer analysis yielded minute-by-minute values for heart rate, heart rate variability. Specialized computer analyses were also performed to describe events associated with apneas, sleep-waking state patterns, and interactions between sleep-waking states and the various physiological parameters. Dissert. Abstr.

N78-28775 Arizona Univ., Tucson.
AVIAN HEMODYNAMIC AND HOMEOSTATIC RESPONSES FOLLOWING HIGH ENVIRONMENTAL TEMPERATURE ACCLIMATION Ph.D. Thesis
Jean Marie VanHandel-Hruska 1978 121 p
Avail: Univ. Microfilms Order No. 78-11520

Birds, like other homeotherms, respond to high environmental temperatures by utilizing a variety of thermoregulatory mechanisms in order to maintain body temperature within the narrow range necessary for life. While these mechanisms result in successful survival during heat exposure, they also compromise other physiological functions of the avian organism. The purpose of this study was to examine the extent to which laying hens can acclimate to high environmental temperature, and the effect of this acclimation process on certain physiological functions. Dissert. Abstr.

N78-28776# Army Armament Rusearch and Development Command, Aberdeen Proving Ground, Md. Chemical Systems Lab.
SAMPLE RETREATMENT DUAL-CELL DETECTOR APPROACH FOR DIFFERENTIATING GROUPS OF MICROBIOLOGICAL MATERIALS BY LUMINOL CHEMILUMINESCENCE Technical Report, 1 Jan. - 31 Oct. 1978
Johnnie M. Albizo and William A. Ambush Feb. 1978 28 p refs
(AD-A053383; AD-E400130) Avail: NTIS HC A03/MF A01 CSCL 15/2

A dual-cell chemiluminescence detection apparatus was devised that differentiated bacteria, tissue cells, and pollen as distinct microbiological material groups by characteristic alterations of luminol chemiluminescence responses resulting from sample pretreatment in H2O at 25 C and 80 C for 2 and 12 minutes and in alkaline silver at 80 C for 12 minutes. The bacterial species Serratia marcescens, Escherichia coli (strain 162), and Bacillus subtilis spores were distinguished as a group from embryonated egg, mouse fibroblasts, and monkey kidney cells after pretreatment in water at 80 C for 2 minutes. Pollen from combined grasses, garden weeds, and combined ragweeds was distinguished from bacteria and tissue cells after pretreatment in alkaline silver at 80 C for 12 minutes. B. subtilis spores were distinguished from the vegetative bacteria, S. marcescens and E. coli, after pretreatment with alkaline silver at 80 C for 12 minutes. The technique may have potential as an auxiliary

tool for verifying and further characterizing bioalarms obtained with current biodetection devices. Author (GRA)

N78-28777# California Univ., Berkeley. Lawrence Berkeley Lab.
POTENTIAL OF ARID ZONE VEGETATION AS A SOURCE OF SUBSTRATES
J. A. Bassham Nov. 1977 44 p refs Presented at Seminar on Microbial Conversion Systems for Food and Fodder Production and Water Management, Kuwait City, Kuwait, 12 Nov. 1977
(Contract W-7405-eng-48)
(LBL-7214; Conf-771158-1) Avail: NTIS HC A03/MF A01

Vegetation in arid zones as a source of substrates is discussed. Considered are the limitations on efficiency of conversion of solar energy to the stored chemical energy of biomass in green plants, and the subsequent biochemical pathways of carbon dioxide fixation and biosynthesis, as well as the potential of plants endogenous to arid zones. Finally, the use of covered agriculture or controlled environmental agriculture is considered both in its present form and in terms of possible extension to the large scale production of stable crops. ERA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N78-28778 George Washington Univ., Washington, D. C.
CARDIOVASCULAR FUNCTION DURING A REACTION TIME TASK AND MENTAL ARITHMETIC Ph.D. Thesis
Nancy Jo Garside Davenport 1978 327 p
Avail: Univ. Microfilms Order No. 7810144

During mental arithmetic all subjects demonstrated an increase in heart rate and cutaneous vasoconstriction. Alterations in contractility, if present, were accompanied by an increased venous return and increased peripheral resistance. Mental tasks, it is concluded, cause cardiovascular alterations which are amenable to measurement by noninvasive procedures, but the changes which are produced by these mental tasks are much smaller than those which are brought about by more direct physical stress. The reaction time sequence involved the presentation of a warning light signal, at which the subject depressed a telegraph key, followed by a respond light signal, at which time the subject released the key as quickly as possible. During this reaction time sequence the heart rate decreased prior to the warning signal, increased following the warning signal, and decreased prior to the respond signal. The measurements of contractility did not show any change, suggesting that the alteration in heart rate was mediated purely by the vagus. Dissert. Abstr.

N78-28779 State Univ. of New York, Buffalo.
NORMOBARIC HYPEROXIA: A NEW LOOK Ph.D. Thesis
Andrea Lynne Harabin 1978 131 p
Avail: Univ. Microfilms Order No. 78-10626

The entire gas transport chain of both O2 and CO2 in ten O2 breathing rabbits, throughout exposure, until death were studied. Particular attention was given to experimental design so that animals were maintained in as near natural conditions as possible. All variables studied were maintained until 8 to 12 hours of death; then animals died showing a combination of two very different patterns; one pulmonary in origin, the other peripheral. Animals showing a predominatly pulmonary pattern survived a longer exposure period and death probably results from arterial hypoxemia. The non-pulmonary trend results in severe lactic acidosis in the face of a well maintained Pa O2 -- interpreted as peripheral hypoxia without arterial hypoxemia. Dissert. Abstr.

N78-28780 Florida Univ., Gainesville.
THE ENERGETICS OF ISOLATED CARDIAC MUSCLE Ph.D. Thesis
Charles Richard Lambert 1977 86 p
Avail: Univ. Microfilms Order No. 78-10968

In order to investigate the model independent mechanical determinants of myocardial energy expenditure a respirometer was designed to study isolated papillary muscles. Feline right ventricular papillary muscles were mounted in a sealed muscle chamber and superfused with an oxygenated polyelectrolyte solution at 31 C. Muscle force was measured with a transducer. Muscle velocity was obtained by active differentiation of the length signal. The mechanical variables determined in the study included afterload or developed force, the time-tension integral or area under the force record, the peak velocity of isotonic shortening, the mean velocity of isotonic shortening, the distance of muscle shortening and the integral of the contraction portion of the velocity-length phase plane trajectory. Dissert. Abstr.

N78-28781# Army Research Inst. of Environmental Medicine, Natick, Mass.
THE NATURE OF THE PERCEPTION OF EFFORT AT SEA LEVEL AND HIGH ALTITUDE
Donald H. Horstman, Richard Weiskopf, and Summer Robinson 16 Dec. 1977 24 p refs
(DA Proj. 3E1-61102-BS-08)
(AD-A051274; USARIEM-M-9/78) Avail: NTIS HC A02/MF A01 CSCL 05/10

This study compared the Rating of Perceived Exertion (RPE) and selected physiological measures, during both short term and prolonged work of equal relative intensities (i.e., % VO2 max), at 4300 m to those at sea level. Ss (N = 20) performed bicycle work at supramaximal intensities, for six minutes each at 60, 80 and 95% VO2 max and to exhaustion at 85% VO2 max. At 4300 m, VO2 max was reduced 19%, while V sub E max and R max increased 17 and 8%, respectively; HR max and RPE max was unchanged. For any given relative work intensity, VO2 and absolute work intensity were of course reduced, while V sub E was about 12% and R about 7% greater at 4300m; again HR was unchanged. At 4300 m, RPE at the lower intensities and early during prolonged work were significantly less than at sea level. These differences were reduced and finally eliminated as work intensity increased toward maximal or as prolonged work continued to exhaustion. Endurance time to exhaustion at 4300 m was not different from that at sea level. To account for the perceptual differences between work at 4300 m and sea level we proposed that RPE was a positively acclerating power function of central influences (tachycardia, tachypnea, dyspnea), and either a linear or positively decelerating power function of local influences (muscular strain). GRA

N78-28782# Army Research Inst. of Environmental Medicine, Natick, Mass.
PERCEPTION OF EFFORT DURING CONSTANT WORK TO SELF-IMPOSED EXHAUSTION
Donald H. Horstman, William P. Morgan, Allen Cymerman, and James Stokes 22 Dec. 1977 27 p refs
(AD-A051275; USARIEM-M-10/78) Avail: NTIS HC A03/MF A01 CSCL 05/10

This study describes the pattern of change in effort sense and the value of this pattern in predicting work end point at relatively high work intensity (80% VO2 max). Patterns of change of various physiological functions were also observed. Two modes of work (walking and running) were compared to ascertain generalizability of results. Subjects were 26 healthy male volunteers. Time to exhaustion (ET) did not differ between walking and running. As work continued during both tasks, significant increases of V(E), V(E)/VO2, V(E)/CO2 and HR and a significant decrease of ET(CO2) were observed; while VO2 and R remained fairly constant. VO2 and V(E) during the run were about 5% greater than during the walk. Ratings of perceived exertion (RPE) from the Borg Scale were identical for both conditions, increasing in near linear fashion from a value of 12.9 at 25% of total work time to 18.9 at exhaustion. RPE obtained at 25 and 50% ET were extrapolated to time of exhaustion; the point of intercept corresponded to RPE for maximal work. At exhaustion, Ss rated perception of respiratory exertion for the walk as less than that for the run; perception of leg exertion was not different for the 2 conditions. Plasma lactate, epinephrine and norepinephrine concentrations following exercise did not differ between the 2 conditions. It is concluded that, with the exception of VO2 and some ventilatory parameters, walking and running at the same relative work intensity resulted in comparable perceptual and physiological responses. Psychophysical judgments made early during work were found to be reasonably accurate predictors of exhaustion time. GRA

N78-28783# Wisconsin Univ. - Madison.
PULMONARY ADAPTATION TO HIGH ALTITUDE Annual Summary Report, 1 Feb. - 18 Nov. 1977
Jerome A. Dempsey 18 Nov. 1977 9 p
(Contract DAMD17-77-C-7006; DA Proj. 3E1-61102-BS-08)
(AD-A049857) Avail: NTIS HC A02/MF A01 CSCL 06/16

This project is aimed at two closely related problems concerning man's adaptation to high altitude hypoxia: (1) the mechanisms which regulate the ionic composition of brain intra- and extra-cellular fluid ICF/ECF in long-term hypoxia, and (2) the role these regulatory factors play in mediating ventilatory acclimatization to hypoxia. In studies of brain ECF in hypoxia the writer has determined the regulation of CSF HCO3(-) movement between plasma and CSF, described the effects of hypoxia on brain P sub CO2 gradients, described the ventilatory response of the awake rat to steady-state ventricular-cisternal perfusion of various (H+), and--in man--has shown that the time-course of ventilatory 'de-acclimatization' from chronic hypoxia is not explained by changes in CSF (H+). Secondly, he has developed techniques for the study of brain intra-cellular pH and cerebral metabolism in dogs. Thirdly, he is well underway in his studies of brain neurotransmitters in hypoxia. That is, assays have been developed, control data has been obtained in many rats, the time-course of ventilatory acclimatization to chronic hypoxia in the awake rat has been described and he has completed initial studies of the affect of specific neurotransmitter blockade on the control of breathing in the awake animal. GRA

N78-28784# Ohio State Univ. Research Foundation, Columbus. Dept. of Aeronautical and Astronautical Engineering.
CARDIOVASCULAR, RENAL AND RESPIRATORY EFFECTS OF HIGH INTENSITY, INTERMEDIATE DURATION, LOW FREQUENCY VIBRATION Final Report, 1 Jun. 1973 - 30 Jun. 1977
Robert M. Nerem and Robert L. Hamlin Sep. 1977 31 p refs
(Grant AF-AFOSR-2526-73)
(AD-A050158; AFOSR-78-0074TR) Avail: NTIS HC A03/MF A01 CSCL 06/19

The results of a research program on the influence of high intensity, intermediate duration, low-frequency wholebody vibration on the cardiovascular system are described. Areas of activity have included the study of in vivo transendothelial albumin transport, in vitro transendothelial cholesterol transport in the presence of oscillatory flow conditions, regional blood flow distribution, aortic pressure and velocity wave forms (this has included the development of a pulsed ultrasonic Doppler velocimeter for noninvasive flow measurements), and aortic lipid deposition. In these studies, the more subtle aspects of the effect of low frequency, wholebody vibration have been examined from the viewpoint of relationships that may exist between the physiological and fluid mechanical aspects of cardiovascular phenomena. GRA

N78-28785# Letterman Army Inst. of Research, San Francisco, Calif.
THE EFFECTS OF ABRUPT ALTITUDE EXPOSURE (4300 m) UPON THE METABOLISM OF GLUCOSE-14 C-UL IN MAN
Herman L. Johnson, C. Frank Consolazio, Raymond F. Burk, Ted A. Daws, and Edward G. Lufkin Oct. 1978 35 p refs
(DA Proj. 3A0-62110-A-827)
(AD-A051764; LAIR-44) Avail: NTIS HC A03/MF A01 CSCL 06/1

The catabolism of infused C14-glucose in sea level natives was compared during initial altitude exposure and at sea level. An increased disappearance of plasma radioactive glucose in two studies and an increased production of C140(2) in the second study were observed. Fasting plasma glucose levels decreased with increased duration of altitude exposure. Altitude exposure enhanced glucagon-mediated hyperglycemia. A shorter duration of hyperglycemia and reduced glucose levels after glucagon would suggest a depletion of liver glycogen stores in the 40-hour exposed men. Plasma levels of growth hormone were increased 6-10 fold during the first four hours at 4,300 meters. Insulin levels were increased after glucagon infusion in both altitude-exposed men and control men concomitant with increased plasma glucose values although the increases were not significantly correlated. These data indicate that glucose catabolism was enhanced during initial altitude exposure with an increased requirement for carbohydrates. Author (GRA)

N78-28786# Franklin Inst. Research Labs., Philadelphia, Pa. Biomedical Group.
BIOLOGICAL EFFECTS OF NONIONIZING ELECTROMAGNETIC RADIATION, VOLUME 2, NO. 3, MARCH 1978 Quarterly Report, Dec. 1977 - Mar. 1978
Bruce H. Kleinstein and Elena P. Saboe Mar. 1978 89 p
Sponsored by the Navy
(Contract TP-7AC024)
(AD-A052779; FIRL-80G-C4735-01) Avail: NTIS HC A05/MF A01 CSCL 06/18

This quarterly digest presents current awareness information on the biological effects of nonionizing electromagnetic radiation (microwave and radiofrequency) in the range of 0 Hz to 100 GHz. The effects of magnetic and electric fields (static and alternating) are also covered. Each issue contains abstracts of English and foreign current literature, summaries of ongoing research investigations, news items, and a directory of meeting and conferences. Author (GRA)

N78-28787# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
ON THE MECHANICAL PROPERTIES OF THE HUMAN INTERVERTEBRAL DISC Interim Report, Nov. 1976 - Jan. 1978
N. D. Panagiotacopulos, R. Bloch, W. G. Knauss, P. Harvey, and M. Patzakis Jan. 1978 172 p refs
(Grant AF-AFOSR-3139-77; AF Proj. 2312)
(AD-A053036; AFOSR-78-0054TR) Avail: NTIS HC A08/MF A01 CSCL 06/16

The human intervertebral disc is a highly inhomogeneous fiber composite pressure vessel. Interest in the mechanical properties of the disc started from a desire to develop a non-invasive diagnostic technique to assess disc damage based on X-ray and computer-aided image enhancement. These would be important in gaging the X-ray detected deformations of the disc under various loads. The water content of the disc material was found to dominate its mechanical behavior. From a study of three-layer specimens, several important aspects of the mechanical properties were established. First, the relaxation behavior is very sensitive to moisture content. Second, water diffuses slowly in the layers. The water apparently acts similar to a solvent in a polymer, effecting a change in the relaxation times. Increasing water content caused a shortening of relaxation times, drying, the opposite effect. Data covering a wide spectrum of relaxation times are presented that include all time scales experienced by the human body. This mechanical characterization provides an estimate of how discs respond to different rates of deformation and loading conditions. The incidence of disc problems with advancing age is explained in terms of the decrease in the moisture content of the disc along with possible changes in the nature of its mucopolysaccharides. Author (GRA)

N78-28788# Army Research Inst. of Environmental Medicine, Natick, Mass.
PREDICTION OF HUMAN HEAT TOLERANCE
Ralph F. Goldman Jul. 1977 30 p refs
(AD-A051276; USARIEM-M-19/77) Avail: NTIS HC A03/MF A01 CSCL 06/19

Human tolerance to heat exposure is limited by body heat storage, as the body is unable to eliminate all the heat it produces and/or receives from the environment, and by the physiologic consequences of such storage. Heat storage of about 80 kcal represents the 'voluntary heat tolerance' limit at which an average, fit, 70 kg man usually decides he is not willing to work much longer in the heat; and increase of 160 kcal in his heat content is associated with a 50% risk of heat exhaustion collapse. As the difference between skin and air temperatures decreases, a demand for evaporative cooling in the heat is imposed by the interplay of 3 factors: (1) the metabolic heat production; (2) the 'effective' solar heat load; and (3) the radiative and convective heat exchange through the clothing insulation. This demand may be greater than the maximum evaporative cooling allowed by 3 other factors; the body's maximum sustainable sweat production (about 1L/hr approximately = to 675 Watts of cooling power);

the limit to sweat evaporation imposed by clothing moisture permeability and thickness; and the difference between the vapor pressure of sweat at the skin surface and the ambient vapor pressure. GRA

N78-28789# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

THE F/FB-111 ESCAPE INJURY MECHANISM ASSESSMENT Report, Oct. 1967 - Jun. 1977

Leon E. Kazarian Oct. 1977 57 p refs
(AD-A052337; AMRL-TR-77-60) Avail: NTIS HC A04/MF A01 CSCL 06/5

All F/FB-111 ejections, for the period October 1967 to June 1977, have been reviewed from an orthopedic biomechanical point of view. A suggested radiographic method for identifying and classifying the unique spinal injury patterns in the F/FB-111 is presented. A type of fracture due to hyperextension of the upper thoracic spine, previously unidentified in the clinical and operational environment and having clinically unfamiliar features, is described. F/FB-111 spinal injuries have been classed as (a) hyperextension injuries, (b) hyperflexion injuries, and (c) combination hyperextension/hyperflexion injuries. Hyperextension injuries are due to the direction of force application of the powered inertia reel, and they occur during the powered inertia reel retraction phase of the ejection sequence. Hyperflexion injuries are due to the ineffectiveness of the upper torso harness, and they occur following ground landing impact. Combination injuries (hyperextension/hyperflexion) are common. The mechanism of spinal injury in most aircrewmen is best understood and most often diagnosed by a combination of careful aircrew questioning, clinical history, and thorough roentgenographic assessment. The operational, clinical, and roentgenographic features should be complementary. A new technical order has been incorporated into the F/FB-111 emergency escape procedures. The severity and frequency of hyperflexion injuries have been reduced. The design deficiency in the configuration of the support and restraint system has been identified, with the result that corrective action has been initiated. GRA

N78-28790# Naval Aerospace Medical Research Lab., Pensacola, Fla.

MOTION SICKNESS SUSCEPTIBILITY: A RETROSPECTIVE COMPARISON OF LABORATORY TESTS Interim Report

J. Lentz and Fred E. Guedry, Jr. 13 Dec. 1977 30 p refs
(AD-A053161; NAMRL-1244) Avail: NTIS HC A03/MF A01 CSCL 06/16

A test battery designed primarily to assess vestibular function has been used for several years to evaluate individuals referred to our laboratory. Because some of the test conditions have proved to be nauseogenic to some individuals, methods of assessing disturbance during these procedures have been used to pursue a second goal, viz., the estimation of motion sickness susceptibility. This report, which focuses on the latter goal, is a retrospective comparison of results on three tests obtained from two groups of subjects, one of which was a group of Navy and Marine aviation personnel who had suffered multiple attacks of airsickness. Results from three laboratory tests of motion sickness susceptibility indicated that there are substantial differences between the airsick group and the unselected comparison group on observer ratings and individual self-ratings of motion sickness symptoms. The provocative stimuli in each laboratory test as well as suggestions concerning how multiple tests may prove effective in predicting motion sickness are discussed.
Author (GRA)

N78-28791# California Univ., Berkeley. Lawrence Berkeley Lab.

DEDICATED MEDICAL ION ACCELERATOR DESIGN STUDY Final Report

Dec. 1977 160 p refs Prepared jointly by Ariz. Univ., Tucson
(Contract W-7405-eng-48; Grant CA-17801)
(LBL-7230; TID-4500-R66) Avail: NTIS HC A08/MF A01

Basing efforts on the current consenus regarding medical requirements, the resulting demands on accelerator and beam delivery systems were analyzed, and existing accelerator technology was reviewed to evaluate the feasibility of meeting these demands. This general analysis was augmented and verified by preparing detailed preliminary designs for sources of therapeutic beams of neutrons, protons and heavy ions. It is indicated that circular accelerators are the most desirable and economical solutions for such sources. Synchrotrons are clearly superior for beams of helium and heavier ions, while synchrotrons and cyclotrons seem equally well suited for protons although they have different strengths and weaknesses. ERA

N78-28792# Rochester Univ., N. Y. School of Medicine and Dentistry.

HEALTH AND SAFETY OF HIGH VOLTAGE TRANSMISSION LINES

S. M. Michaelson 1977 33 p refs Presented at the Workshop on 765 kV Transmission, Cooperstown, N. Y., 6 Oct. 1977
(Contract EY-76-C-02-3490)
(UR-3490-1255; Conf-7710123) Avail: NTIS HC A03/MF A01

Sufficient scientific data are currently available upon which to make an accurate judgment concerning the health, safety, and general biological environmental effects of high voltage transmission lines. There is no demonstrable biological effect which may be hazardous to health or safety or to the general biological environment as a result of the presence of electric and magnetic fields from high voltage transmission lines. Results are summarized from studies on genetic effects, effects on fertility, growth, and development of rats and chicks, serum triglycerides, and circadian rhythms of experimental animals. ERA

N78-28793# Advisory Group for Aerospace Research and Development, Paris (France).

FIFTH ADVANCED OPERATIONAL AVIATION MEDICINE COURSE

G. F. Perdriel, ed. Jun. 1978 83 p Course held at L'Ecole d'Application du Service de Sante pour l'Armee de l'Air, Paris, 12-23 Sep. 1977
(AGARD-R-666; ISBN-92-335-1287-1) Avail: NTIS HC A05/MF A01

Procedures in opthalmology and oto-rhino-laryngology for selecting flying personnel are discussed. For individual titles, see N78-28794 through N78-28805.

N78-28794# Advisory Group for Aerospace Research and Development, Paris (France).

COLOR VISION IN AVIATION

J. P. Chevaleraud (Service Ophtalmologie C.P.E.M.P.N., Paris) *In its* 5th Advanced Operational Aviation Med. Course Jun. 1978 p 1-6 (For primary document see N78-28793 19-52)
Avail: NTIS HC A05/MF A01

The role of color perception in all phases of aeronautics is outlined with emphasis on the safe operation of the flight vehicle. Systematic detection of color vision abnormalities in flight personnel candidates is recommended. Various methods used to detect dyschromatopsias are briefly described. J.M.S.

N78-28795# Advisory Group for Aerospace Research and Development, Paris (France).

VISION AT LOW LUMINANCE LEVELS IN AVIATION

J. P. Chevaleraud (Service Ophtalmologie C.P.E.M.P.N., Paris) *In its* 5th Advanced Operational Aviation Med. Course Jun. 1978 p 7-11 (For primary document see N78-28793 19-52)
Avail: NTIS HC A05/MF A01

Low luminous vision in aeronautics, on the ground as well as in flight, is discussed in terms of pilot selection. Preadaptation and administration of medicines to improve performance are briefly assessed. J.M.S.

N78-28796# Advisory Group for Aerospace Research and Development, Paris (France).

GLARE AND ITS ADVERSE CONSEQUENCES IN AVIATION

J. P. Chevaleraud (Service Ophtalmologie C.P.E.M.P.N., Paris) *In its* 5th Advanced Operational Aviation Med. Course Jun. 1978 p 13-16 (For primary document see N78-28793 19-52)
Avail: NTIS HC A05/MF A01

The effects of glare in the aeronautical environment are discussed. Sensory disturbances, deterioration of the optical image, and psychological disturbances are considered along with individual variations in the resistance to glare and in recovery of visual acuity after exposure. Selection of flight personnel as a

function of sensitivity to glare and systematic checking at each follow-up medical examination is recommended. Methods to improve recovery and protective devices are described. J.M.S.

N78-28797# Advisory Group for Aerospace Research and Development, Paris (France).
DEPTH VISION IN AVIATION
P. J. Manent (Service Ophtalmologie, Hospital d'Instruction des Armees D. Larrey, Versailles, France) *In its* 5th Advanced Operational Aviation Med. Course Jun. 1978 p 17-22 (For primary document see N78-28793 19-52)
Avail: NTIS HC A05/MF A01

The significance of depth perception in aviation is discussed for the following operations: landing, in flight, ground maneuvers--taxiing, weapon firing, and parachute jumping. Monocular and binocular factors involved in depth perception are described along with methods of measurement in flight personnel to predict visual performance. Extrinsic and intrinsic factors affecting depth vision are considered including ground configurations at low altitude, speed, light environment, sensorimotor, fatigue, and air sickness. J.M.S.

N78-28798# Advisory Group for Aerospace Research and Development, Paris (France).
VISUAL PROBLEMS RAISED BY LOW ALTITUDE HIGH SPEED FLIGHT
P. J. Manent (Service Ophtalmologie, Hospital d'Instruction des Armees D. Larrey, Versailles, France) *In its* 5th Advanced Operational Aviation Med. Course Jun. 1978 p 23-28 (For primary document see N78-28793 19-52)
Avail: NTIS HC A05/MF A01

Visual problems associated with visual flight rule (VFR) reconnaissance or photographic missions or bombing missions are discussed. Physical, physiological, and psychological stresses of low altitude high speed flight which affect vision by modifying the visual information and the visual performance and by disturbing the visual function are considered. Means designed to ensure an optimal man machine interaction, filling the mission requirements and following safety rules, are outlined. Pilot selection, periodic check ups, pilot training, protective devices, and human factors engineering are among the factors included. J.M.S.

N78-28799# Advisory Group for Aerospace Research and Development, Paris (France).
THE CONTRIBUTION OF ELECTROPHYSIOLOGY
J. P. Chevaleraud (Service Ophtalmologie C.P.E.M.P.N., Paris) *In its* 5th Advanced Operational Aviation Med. Course Jun. 1978 p 29-34 (For primary document see N78-28793 19-52)
Avail: NTIS HC A05/MF A01

Visual electrophysiological examinations are discussed in relation to the selection and medical surveillance of flight personnel. The diagnostic and prognostic value of examinations is cited. It is stated that electrophysiological examinations are objective and provide information that is easily documented. J.M.S.

N78-28800# Advisory Group for Aerospace Research and Development, Paris (France).
AUDITORY INFORMATION OF FLYING PERSONNEL: ANATOMICAL AND PHYSIOLOGICAL BASIS
L. R. Bondes(Service Oto-rhino-laryngologie, Hospital d'Instruction des Armees D. Larrey, Versailles, France) *In its* 5th Advanced Operational Aviation Med. Course Jun. 1978 p 35-44 (For primary document see N78-28793 19-52)
Avail: NTIS HC A05/MF A01

An anatomical review of the auditory system is presented along with a study of physiological acoustics. An analysis of the physiology of hearing is included. F.O.S.

N78-28801# Advisory Group for Aerospace Research and Development, Paris (France).
AVIATOR HEARING LOSS
P. Blanc (Service O.R.L., C.P.E.M.P.N., Paris) *In its* 5th Advanced Operational Aviation Med. Course Jun. 1978 p 45-46 (For primary document see N78-28793 19-52)
Avail: NTIS HC A05/MF A01

Hearing loss in flying personnel is discussed in terms of frequencies. F.O.S.

N78-28802# Advisory Group for Aerospace Research and Development, Paris (France).
PSYCHOPATHOLOGY IN EQUILIBRATION IN AEROSPACE MEDICINE
L. R. Bondes (Service Oto-rhino-laryngologie, Hospital d'Instruction des Armees D. Larrey, Versailles, France) *In its* 5th Advanced Operational Aviation Med. Course Jun. 1978 p 47-58 (For primary document see N78-28793 19-52)
Avail: NTIS HC A05/MF A01

Physiological aspects of equilibrium are discussed in terms of induced reflex responses. The physiopathalogy of equilibrium in flight is described. F.O.S.

N78-28803# Advisory Group for Aerospace Research and Development, Paris (France).
NEW ASPECTS OF BAROTRAUMA IN O.R.L.
L. R. Bondes(Service Oto-rhino-laryngologie, Hospital d'Instruction des Armees D. Larrey, Versailles, France) *In its* 5th Advanced Operational Aviation Med. Course Jun. 1978 p 59-66 (For primary document see N78-28793 19-52)
Avail: NTIS HC A05/MF A01

The conditions for atmospheric variations in man are reviewed along with the physiology of pressure changes in the ear. The sinus ventilation mechanism is described. F.O.S.

N78-28804# Advisory Group for Aerospace Research and Development, Paris (France).
NOSE PATHOLOGY OF FLYING PERSONNEL
P. Blanc (Service Oto-rhino-laryngologie, C.P.E.M.P.N., Paris) *In its* 5th Advanced Operational Aviation Med. Course Jun. 1978 p 67-70 (For primary document see N78-28793 19-52)
Avail: NTIS HC A05/MF A01

Techniques for the practical examination of the nasal cavity, sinuses and Eustachian tubes are discussed along with chronic nasal affections due to infections, or allergies. F.O.S.

N78-28805# Advisory Group for Aerospace Research and Development, Paris (France).
PRACTICAL PROBLEMS RAISED BY OTO-RHINO-LARYNGOLOGY STANDARDS
P. Blanc (Service Oto-rhino-laryngologie, C.P.E.M.P.N., Paris) *In its* 5th Advanced Operational Aviation Med. Course Jun. 1978 p 71-74 (For primary document see N78-28793 19-52)
Avail: NTIS HC A05/MF A01

Otoscopic and cochlear problems are studied in terms of clinical and functional examinations. F.O.S.

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

No abstracts in this category.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N78-28806# Civil Aeromedical Inst., Oklahoma City, Okla.
COMPARISON OF THE VISUAL PERCEPTION OF A RUNWAY MODEL IN PILOTS AND NONPILOTS DURING SIMULATED NIGHT LANDING APPROACH
Henry W. Mertens Mar. 1978 24 p refs
(AD-A054450; FAA-AM-78-15) Avail: NTIS HC A03/MF A01 CSCL 01/2

Relative motion parallax (a difference in rate of apparent movement of objects in the visual field), a cue that can contribute to visual judgments of glide path angle, was studied for its effect on the nighttime approach problem. Pilots and nonpilots adjusted the slant of a model runway to make it appear horizontal under nighttime conditions on dynamic trials as the model approached them, and on static trials with the model stationary. In a second experiment, pilots and nonpilots performed the same task in dynamic trials while viewing the model in a dark field as before, and while viewing the model within a window which provided a stable visual frame of reference. Pilots also made supplementary judgments in which they verbally estimated magnitude of simulated approach angle in degrees or adjusted the model to produce a 3 deg approach angle. Neither flying experience nor a visual frame of reference enhanced sensitivity to relative motion parallax. However, errors in horizontal adjustments were smaller in pilots, indicating that flying experience enhances other cues in the runway image. G.G.

N78-28807*# Life Systems, Inc., Cleveland, Ohio.
ADVANCED INSTRUMENTATION CONCEPTS FOR ENVIRONMENTAL CONTROL SUBSYSTEMS Final Report, Jul. 1976 - Jun. 1978
P. Y. Yang, F. H. Schubert, J. R. Gyorki, and R. A. Wynveen Jun. 1978 59 p refs
(Contract NAS2-9251)
(NASA-CR-152100; ER-309-6) Avail: NTIS HC A04/MF A01 CSCL 05H

Design, evaluation and demonstration of advanced instrumentation concepts for improving performance of manned spacecraft environmental control and life support systems were successfully completed. Concepts to aid maintenance following fault detection and isolation were defined. A computer-guided fault correction instruction program was developed and demonstrated in a packaged unit which also contains the operator/system interface. G.G.

N78-28808# Wayne State Univ., Detroit, Mich. Dept. of Industrial Engineering and Operations Research.
HUMAN FACTORS REQUIREMENTS FOR FINGERTIP REACH CONTROLS Final Report, Jul. 1975 - Aug. 1977
R. R. Mourant, E. Moussa-Hamouda, and J. M. Howard Sep. 1977 123 p
(Contract DOT-HS-5-01192)
(PB-278811/5; DOT-HS-803267) Avail: NTIS HC A06/MF A01 CSCL 13F

A project was instituted to develop human factors recommendations for fingertip controls. Interviews were conducted with 405 drivers of cars equippped with fingertip reach controls. The study indicated that performance on stalk mounted control functions was faster and required less direct looks than performance on dash mounted functions. It was recommended that the turn signal, headlight beam selector and flash-to-pass controls be located on one left stalk. It was also recommended that the wiper on/off, wiper speed and washer controls be located to the left of the driver at fingertip reach, and if stalk mounted, on the same stalk. It was suggested that future research be conducted on assessing the potential of putting additional controls at fingertip reach. GRA

N78-28809# Air Force Human Resources Lab., Brooks AFB, Tex.
PERFORMANCE MEASUREMENT OF MAINTENANCE
John P. Foley, Jr. Dec. 1977 30 p refs Presented at the Symp. on Productivity Enhancement: Personnel Performance Assessment in Navy Systems, 12-14 Oct. 1977
(AF Proj. 1710)
(AD-A053475; AFHRL-TR-77-76) Avail: NTIS HC A03/MF A01 CSCL 05/9

This paper discusses the status of performance measurement PM for maintenance. During and after World War II, both Navy and Air Force maintenance training programs made extensive use of formal job task performance tests. But for economy reasons, these tests were later abandoned in favor of paper-and-pencil theory and job knowledge tests. Considering the results of later research, these actions were most unfortunate. This research has indicated that such paper-and-pencil tests do not indicate how well individuals can perform the tasks of their jobs. Even though PM were used extensively during and after World War II, there have been few systematic research and development R/D efforts concerning the refinement of PM for maintenance. This paper briefly describes the AFHRL R/D efforts for PM which have given due consideration to the man-machine interface. The rather promising results of efforts to develop symbolic substitutes for PM are also presented. In addition, several problems concerning the research, development, and implementation of PM are discussed. The paper ends with proposals for future R/D efforts based on what has already been accomplished. Author (GRA)

N78-28810# Army Aeromedical Research Lab., Fort Rucker, Ala.
PHYSIOLOGICAL PARAMETERS ASSOCIATED WITH EXTENDED HELICOPTER FLIGHT MISSIONS: AN ASSESSMENT OF PUPILLOGRAPHIC DATA Final Report
David B. Anderson and Wun C. Chiou Sep. 1977 22 p refs (DA Proj. 3A1-61102-B-71P)
(AD-A052771; USAARL-77-21) Avail: NTIS HC A02/MF A01 CSCL 06/16

Six Army aviators served as subjects in a study of various psychological and physiological parameters associated with extended helicopter flight missions. This report presents the results of the initial pupillographic data collected in this study as well as the problems encountered and the recommended solutions. It was shown that the waveform characteristics of the pupillary reflex response to light were irregular. Furthermore, the blinking frequency increased and the pupillary amplitude varied as a function of loaded flight task. Results also revealed that the average pupillary diameter was smaller in the morning than in the evening. This report recommends the future use of pupillography in which an evaluation of pilot alertness is needed. Author (GRA)

N78-28811# Naval Research Lab., Washington, D. C.
EVALUATION OF AN ELECTROCHEMICAL DETECTOR FOR TRACE CONCENTRATIONS OF HYDRAZINE COMPOUNDS IN AIR Final Report
R. A. Saunders, J. J. DeCordo, B. J. Stammerjohn, and R. J. Kautter 13 Apr. 1978 35 p refs
(AD-A054636; AD-E000156; NRL-8199) Avail: NTIS HC A03/MF A01 CSCL 07/1

Large quantities of nitrogen tetraoxide and hydrazine compounds will be used in space shuttle operations. These materials are toxic, and the nearby environment must be monitored for escaped fuels at concentrations of a few parts per billion. Based on an analytical method prototype portable monitors have been built and evaluated. The instruments meet design criteria and should be satisfactory for NASA's intended purpose. GRA

N78-28812# National Technical Information Service, Springfield, Va.
PROTECTIVE CLOTHING. PART 1: ARCTIC AND TROPICAL ENVIRONMENTS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Apr. 1978
Mary E. Young Apr. 1978 119 p refs Supersedes NTIS/PS-77/0318; NTIS/PS-76/0267
(NTIS/PS-78/0371/1; NTIS/PS-77/0318; NTIS/PS-76/0267) Avail: NTIS HC $28.00/MF $28.00 CSCL 06Q

Reports on clothing for environmental protection in extreme climates are cited, including reports on especially developed fabrics and textiles, insulating methods, physiological and psychological responses of users, mobility and dexterity of wearers, care of specialized clothing, and human factors involved. (This updated bibliography contains 114 abstracts, 15 of which are new entries to the previous edition.) Author

N78-28813# National Technical Information Service, Springfield, Va.
PROTECTIVE CLOTHING. PART 2: FIRE AND RADIATION ENVIRONMENTS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Apr. 1978
Mary E. Young Apr. 1978 101 p Supersedes NTIS/PS-77/0319; NTIS/PS-76/0268
(NTIS/PS-78/0372/9; NTIS/PS-77/0319; NTIS/PS-76/0268) Avail: NTIS HC $28.00/MF $28.00 CSCL 06Q

Research on clothing and equipment for maximum protection while fighting fires and in radiation conditions is described in

the reports abstracts. Treatment of fibers and textiles, design of clothing, testing for physiological tolerances, methods of decontamination after exposure, and equipment acceptability are topics included. (This updated bibliography contains 96 abstracts, 12 of which are new entries to the previous edition.) GRA

N78-28814# National Technical Information Service, Springfield, Va.
PROTECTIVE CLOTHING. PART 3: SURVIVAL, AIRCRAFT, AND COMBAT ENVIRONMENTS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Apr. 1978
Mary E. Young Apr. 1978 198 p Supersedes NTIS/PS-77/0320; NTIS/PS-76/0269
(NTIS/PS-78/0373/7; NTIS/PS-77/0320; NTIS/PS-76/0269)
Avail: NTIS HC $28.00/MF $28.00 CSCL 06Q

The bibliography cites reports on design, testing, and evaluation of protective apparel for pilots in various conditions of climate and gravity, for military personnel in combat conditions, for persons in special circumstances of exposure and survival, such as the ocean environment, and for other aviation personnel. (This updated bibliography contains 193 abstracts, 43 of which are new entries to the previous edition.) GRA

N78-28815# National Technical Information Service, Springfield, Va.
PROTECTIVE CLOTHING. PART 4: INDUSTRIAL ENVIRONMENTS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Apr. 1978
Mary E. Young Apr. 1978 151 p Supersedes NTIS/PS-77/0321; NTIS/PS-76/0270
(NTIS/PS-78/0374/5; NTIS/PS-77/0321; NTIS/PS-76/0270)
Avail: NTIS HC $28.00/MF $28.00 CSCL 06Q

Protective clothing for industrial atmospheres including protection from explosive materials and fuels is covered in this bibliography. Cited are studies on the design, testing, and evaluation of boots, gloves, and helmets, protection against industrial dusts, and human tolerances in the industrial environment. GRA

N78-28050 European Space Agency, Paris (France).
VALIDATION OF A MODEL OF A HUMAN PILOT
Dominique Soulatges *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-5 (ESA-TT-459) May 1978 p 109-111 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-5, Sep.-Oct. 1977 p 325-326 Original report in FRENCH previously announced as A78-16623 (For primary document see N78-28044 19-01)
Avail: NTIS HC A06/MF A01

N78-29037# Joint Publications Research Service, Arlington, Va.
TWO-DIMENSIONAL LINEAR MODELS OF TWO-LEGGED WALKING
V. V. Beletskiy and T. S. Kirsanova *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 53-68 refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Tverdogo Tela (Moscow), no. 4, 1976 p 51-62 (For primary document see N78-29032 19-99)
Copyright. Avail: NTIS HC A06/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N78-28816 Case Western Reserve Univ., Cleveland, Ohio.
THE MECHANICAL DISCOVERY OF PROBLEM SOLVING STRATEGIES Ph.D. Thesis
Michael Milan Goldstein 1978 149 p
Avail: Univ. Microfilms Order No. 78-09279

These methods require problem dependent parameters which the methods use to solve the problem. The conditions of a method can be satisfied if good parameters can be given to the method. Two programs were written to mechanically generate these parameters. One generates the differences and triangular tables of connection that the General Problem Solver (GPS) strategy needs to solve a problem. The second generates a set of equations determining the important state components of a game for the strategy used to solve decomposable games. These programs were successfully tested on a variety of problems.
Dissert. Abstr.

N78-28817# Stanford Linear Accelerator Center, Calif.
SIMPLE CAMAC TEST SYSTEM BASED ON THE S-100 BUS
D. Horelick and R. MacGregor Oct. 1977 5 p refs Presented at the IEEE 1977 Nucl. Sci. Symp., San Francisco, 19-21 Oct. 1977
(Contract EY-76-S-03-0326)
(SLAC-PUB-2035; Conf-771023-45) Avail: NTIS HC A02/MF A01

A simple CAMAC test system based upon the use of the S-100 (Hobbyist) bus was implemented at SLAC. The IMSAI 8080 computer is used, containing 16K bytes of RAM and 1K bytes of EPROM. All programming and operator interaction takes place by means of a thermal printer-keyboard, and all test programs are written in IMSAI BASIC. The system was used to test components, CAMAC modules, and complex CAMAC systems. ERA

N78-28818# Stanford Linear Accelerator Center, Calif.
SEMI-AUTONOMOUS CONTROLLER FOR DATA ACQUISITION, THE BRILLIANT ADC
M. Breidenbach Oct. 1977 5 p refs Presented at the IEEE 1977 Nucl. Sci. Symp., San Francisco, 19-21 Oct. 1977
(Contract EY-76-S-03-0326)
(SLAC-PUB-2032; Conf-771023-44) Avail: NTIS HC A02/MF A01

A set of high speed 16-bit computers and ADC's were designed and built for the data collection, compression, and correction system of the SLAC/LBL Mark II Magnetic Detector The Brilliant ADC controls the analog multiplexing of a CAMAC crate of data acquisition modules, digitizes the analog data, and executes microprogrammed algorithms for data handling and correction. ERA

N78-28819# California Univ., Livermore. Lawrence Livermore Lab.
DASLL: DESIGN AUTOMATION SYSTEM AT LAWRENCE LIVERMORE LABORATORY. USERS' MANUAL
R. J. Smith, II and W. G. Magnuson, Jr. Jan. 1978 109 p

(Contract W-7405-eng-48)
(UCID-17708) Avail: NTIS HC A06/MF A01

Implementation of the DASLL system to lay out printed circuit boards by using the OCTOPUS CDC 7600 computer system is described. ERA

N78-28820# Sandia Labs., Albuquerque, N. Mex.
SPCDS/NOVA 3 INTERFACE MANUAL
Robert Holt Apr. 1978 35 p
(Contract EY-76-C-04-0789)
(SAND-78-0473) Avail: NTIS HC A03/MF A01

The purpose of this interface is to take information from an Air Force small permanent communications and display segment (SPCDS) and format it for a dual Nova 3 Computer. Two types of information, alarm and access data, require two separate I/O Bus ports to the Nova. Data are taken from SPCDS in such a way that any failure of the interface circuits will not affect normal SPCDS operation. The interface is a four-channel device capable of receiving up to four channels of SPCDS data. A four-channel SPCDS has a capacity of 316 sensors. The interface consists of 18 plug-in printed circuit cards in a card cage. Seven cards are required to process the four channels of alarm data, and ten are used for access data. These two aspects of the interface are described separately. ERA

N78-28821# Logistics Management Inst., Washington, D. C.
USER'S GUIDE: DATA BASE MAINTENANCE SYSTEM OF THE PIES
M. Shaw, M. Fiorello, G. Starr, and J. Susick Oct. 1977 41 p
(Contract EM-77-C-01-8561)
(HCP/170070-01) Avail: NTIS HC A03/MF A01

The PIES data base management system (DBMS) is designed to control and document the PIES data and the PIES data changes. In addition, an on-retrieval capability is available to identify the current PIES data values. As an integral part of the DBMS, there is a PIES data base administrator (DBA), who is responsible for the integrity of the PIES data and the level and quality of its associated documentation. The DBA is also responsible for maintaining the DBMS itself and for providing assistance in its usage. The data query program provides on-line retrieval of the PIES data values and data descriptions. The PIES data tracking report program produces reports documenting the PIES data and changes made to the PIES data. User procedures and instructions for completing the DBMS forms are also discussed.
Author (ERA)

N78-28822# Logistics Management Inst., Washington, D. C.
ADMINISTRATOR'S GUIDE: DATA BASE MAINTENANCE SYSTEM OF THE PIES
M. Shaw Oct. 1977 37 p
(Contract EM-77-C-01-8561)
(HCP/170070-02) Avail: NTIS HC A03/MF A01

The guide for the administrator of the data base maintenance system (DBMS) is given. Instructions are provided on how to use the data tracking update program (TRAKUP) and the data dictionary load program (DDLOAD). TRAKUP is used to update the PIES data values and the PIES data documentation. DDLOAD is used to generate the data dictionary that contains descriptive names for rows and columns of PIES data tables; beside loading the data dictionary from a card-image file, the program can print a report of the data dictionary. Also discussed are DBA procedures, instructions for completing the PIES data change request load, DMBS TSO procedures and JCL, and the DBMS file security system. Author (ERA)

N78-28823# Sandia Labs., Albuquerque, N. Mex.
SANDIA LABORATORIES TECHNICAL CAPABILITIES: COMPUTATION SYSTEMS
Dec. 1977 25 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0767) Avail: NTIS HC A02/MF A01

The computation systems capabilities and several selected applications of these capabilities are presented to illustrate the extent to which they can be applied in research and development programs. ERA

N78-28824# Oak Ridge National Lab., Tenn. Computer Sciences Div.
INTER-COMPUTER FILE TRANSFER PRIMITIVES
R. D. Burris Mar. 1978 37 p
(Contract W-7405-eng-26)
(ORNL/CSD/TM-47) Avail: NTIS HC A03/MF A01

A set of functions required by or useful to a file transfer capability is defined along with standard interfaces to subroutines providing those functions. Adherence to these standards provides the user with program transportability and hardware independence for all computers supporting these subroutines. ERA

N78-28825# Argonne National Lab., Ill.
DATA ACQUISITION AND EXPERIMENT CONTROL VIA CAMAC
J. E. Kulaga and J. W. Tippie 1977 6 p refs Presented at DECUS Meeting, San Diego, Calif., 28 Nov. 1977
(Contract W-31-109-eng-38)
(CONF-771144-4) Avail: NTIS HC A02/MF A01

The integration of CAMAC into a data acquisition system developed under DOS/BATCH-11 for the Physics Division of Argonne National Laboratory is discussed. The widely varying needs of the physicists and the characteristics of the CAMAC hardware used were the prime design considerations which resulted in a software system employing direct-interrupt vectoring and table-lookup vectoring for CAMAC LAM's, core-resident and dynamically loadable routines, and a general-purpose CAMAC data acquisition routine. ERA

N78-28826# Montedel-Montecatini Edison Elettronica S.p.A., Milan (Italy). LABEN Div.
RTU STUDY Final Report
Paris ESA Sep. 1977 162 p
(Contract ESTEC-2298/74)
(ESA-CR(P)-1055) Avail: NTIS HC A08/MF A01

The physical, functional, and electrical characteristics of the remote terminal unit (RTU) are described. The RTU is the peripheral part of the modular onboard data handling system and it responds to databus instructions sent by the central terminal unit. Topics dealt with include system description, RTU performances, RTU functional description, RTU interface characteristics, power supply, technology, modularity, redundancy philosophy, and testing. ESA

N78-28827# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
ASSEMBLER COMPILER FOR THE INTEL 8080 MICROPROCESSOR [COMPILATORE ASSEMBLER PER IL MICROCALCOLATORE INTEL 8080]
Pasquale Cerullilrelli Jul. 1977 52 p refs In ITALIAN
(LPS-77-18) Avail: NTIS HC A04/MF A01

The implementation criterions and the user instructions for an assembler compiler for the Intel 8080 microprocessor realized on the HP 2116 B computer are presented. ESA

N78-28828# Central Electricity Generating Board, London (England).
THE WATCHDOG: COMPUTER INTERFACE MONITOR
T. R. Ecott Feb. 1978 6 p
(TDB-295) Avail: NTIS HC A02/MF A01

The portable self-contained device described permits continuous monitoring of a communications interface of a computer and facilitates unmanned use of the computer. Inactivity of the interface initiates a warning by the WATCHDOG, during which time a loud hooter sounds to warn any operating staff present of an error. If the computer is unmanned and the WATCHDOG is not manually reset, the WATCHDOG will operate an internal relay, which may be wired via an external lead, to switch on or off any mains-powered slave device, including the computer itself. Author (ESA)

N78-29033# Joint Publications Research Service, Arlington, Va.
PROGRESS WITH AUTOMATED SYSTEMS REPORTED
D. G. Zhimerin *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 18-23 Transl. into ENGLISH from Ekon. Gazeta (USSR), no. 33, May 1978 p 7 (For primary document see N78-29032 19-99)
Copyright. Avail: NTIS HC A06/MF A01

N78-29034# Joint Publications Research Service, Arlington, Va.
MORE EFFICIENT COST-ACCOUNTING MANAGEMENT WITH ELECTRONIC COMPUTERS
K. Kozub *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 33-36 Transl. into ENGLISH from Pravda (Moscow), 22 May 1978 p 2 (For primary document see N78-29032 19-99)
Copyright. Avail: NTIS HC A06/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N78-28829 Brown Univ., Providence, R. I.
OPTIMIZATION THROUGH MIGRATION OF FUNCTIONS IN A LAYERED FIRMWARE-SOFTWARE SYSTEM Ph.D. Thesis
John Edward Stockenberg 1977 215 p
Avail: Univ. Microfilms Order No. 78-09099

A partially automated methodology is presented for improving the performance of an application program running on a layered firmware-software system. This methodology generalizes the technique of architecture synthesis or redefinition. Architecture synthesis refers to the replacement of application oriented software by functionally equivalent firmware or hardware for the purpose of improving application program performance. The methodology presented, called vertical migration, extends the architecture synthesis technique to allow functions to be migrated between the layers of a hierarchically structured firmware-software system. This methodology uses an interactive graphic system, STRUCT, for examining dynamic program behavior and CPU use. This system allows programs at any level to be analyzed without interferring with their real time behavior. Author

N78-28830*# Vought Corp., Hampton, Va.
PLOTIT-METHOD OF INTERACTIVELY PLOTTING INPUT DATA FOR THE VORLAX COMPUTER PROGRAM
Frederick M. Denn Jun. 1978 44 p ref
(Contract NAS1-13500)
(NASA-CR-158896) Avail: NTIS HC A03/MF A01 CSCL 09B

Geometric input plotting to the VORLAX computer program by means of an interactive remote terminal is reported. The software consists of a procedure file and two programs. The programs and procedure file are described and a sample execution is presented. G.G.

N78-28831*# M and S Computing, Inc., Huntsville, Ala.
INTERACTIVE SIGNAL ANALYSIS AND ULTRASONIC DATA COLLECTION SYSTEM USER'S MANUAL Final Report
G. R. Smith 6 Jun. 1978 40 p
(Contract NAS8-32490)
(NASA-CR-150745; Rept-78-066) Avail: NTIS HC A03/MF A01 CSCL 09B

The interactive signal analysis and ultrasonic data collection system (ECHO1) is a real time data acquisition and display system. ECHO1 executed on a PDP-11/45 computer under the RT11 real time operating system. Extensive operator interaction provided the requisite parameters to the data collection, calculation, and data modules. Data were acquired in real time from a pulse echo ultrasonic system using a Biomation Model 8100 transient recorder. The data consisted of 2084 intensity values representing the amplitude of pulses transmitted and received by the ultrasonic unit. J.A.M.

N78-28832*# Vought Corp., Hampton, Va.
SOME PROGRAMMING TECHNIQUES FOR INCREASING PROGRAM VERSATILITY AND EFFICIENCY ON CDC EQUIPMENT Final Report
Sherwood H. Tiffany and Jerry R. Newsom Aug. 1978 81 p refs
(Contract NAS1-13500)
(NASA-CR-3033) Avail: NTIS HC A05/MF A01 CSCL 09B

Five programming techniques used to decrease core and increase program versatility and efficiency are explained. The techniques are: (1) dynamic storage allocation, (2) automatic core-sizing and core-resizing, (3) matrix partitioning, (4) free field alphanumeric reads, and (5) incorporation of a data complex. The advantages of these techniques and the basic methods for employing them are explained and illustrated. Several actual program applications which utilize these techniques are described as examples. J.A.M.

N78-28833# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
A COMPARISON OF PROGRAMMING LANGUAGES FOR SOFTWARE ENGINEERING Interim Report
Mary Shaw, Guy T. Almes, Joseph M. Newcomer, Brian K. Reid, and William A. Wulf Apr. 1978 98 p refs
(Contract F30602-75-C-0218)
(AD-A053562; RADC-TR-78-58) Avail: NTIS HC A05/MF A01 CSCL 09/2

Four programming languages (FORTRAN, COBOL, JOVIAL, and the proposed DOD standard -- variously called 'DOD-1, 'Strawman', 'Woodman', 'Tinman', and 'Ironman') are compared in the light of modern ideas of good software engineering practice. The comparison begins by identifying a core for each language that captures the essential properties of the intent of the language designers. These core languages then serve as a basis for the discussion of the language philosophies and the impact of the language on gross program organization and on the use of individual statements. GRA

N78-28834# IBM Federal Systems Div., Gaithersburg, Md.
PROGRAMMING SUPPORT LIBRARY Interim Report
Griffiss AFB, N.Y. RADC Mar. 1978 74 p refs
(Contract F30602-76-C-0016)
(AD-A053658; RADC-TR-77-346) Avail: NTIS HC A04/MF A01 CSCL 09/2

The Programming Support Library (PSL) is a software package designed to provide the facilities for organizing and controlling the development and maintenance of computer programs. The structure and operation of the PSL is oriented toward supporting structured programming techniques (i.e., Top-Down Design and Integration, Use of Structured Source). The PSL has COBOL, FORTRAN, and JOVIAL precompilers to accommodate structured source code input. This report briefly describes the initial PSL development philosophy, the basic functional capabilities and current configuration of the PSL, and the supporting documentation which can be made available. GRA

N78-28835# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.
GENFIT: A GENERALIZED, INTERACTIVE ARBITRARY FUNCTION-TO-DATA FITTING ROUTINE Final Report
J. Terrence Klopcic Apr. 1978 37 p refs
(DA Proj. 1L1-62618-AH-80)
(AD-A054642; AD-E430035; ARBRL-MR-02832) Avail: NTIS HC A03/MF A01 CSCL 09/2

The GENFIT code is an extremely versatile, multi-variable, multi-parameter function to data fitting routine. Because of its simplified, complete interactive input, and many defaults, the program is also easy-to-use. Initial guesses are required; however, the search is sensitive to these guesses only if the data-producing experiment was ill-conditioned to the parameters being determined. The available output options include an easy-to-use plotting package which yields graphical comparisons between function and data. Author (GRA)

N78-28836# California Univ., Livermore. Lawrence Livermore Lab.
SOCKITTOME: AN INTERACTIVE DATA PROCESSING CODE
W. S. Derby, M. E. Hummel, E. C. Lee, and R. D. Neifert 16 Sep. 1977 59 p refs
(Contract W-7405-eng-48)
(UCID-17733) Avail: NTIS HC A04/MF A01

SOCKITTOME is a conversational data manipulation and processing program written for the 7600 computer with teletype control. THe basic philosophy behind the program was to design

a conversational code that would allow a user to control interactively a flexible data conversion process. SOCKITTOME provides the input/output routines and mathematical analysis routines needed to control the process. Another aspect of the design philosophy is to have a code which can be used by a person with minimum knowledge of how the computer system operates. Such knowledge needed is how to communicate with the computer through the teletype, an understanding of data input and output, and tape and disk storage procedures. Generally, this knowledge can be acquired with little effort on the part of users. It is important for the person using results of a computer code to understand how the code works. This includes such diverse things as data structures, output formats, algorithms, sequence of operations, etc. ERA

N78-28837# Sandia Corp., Livermore, Calif. Electronics Development Div.
R7912 TRANSIENT DIGITIZER FORTRAN COMPATIBLE SUBROUTINES FOR THE PDP-11 (RT-11)
L. M. Watkins Mar. 1978 19 p
(Contract EY-76-C-04-0789)
(SAND-77-8717) Avail: NTIS HC A02/MF A01

Assembly-language software subroutines were developed for the R7912 waveform digitizer which are RT-11 FORTRAN compatible and run on the PDP-11. Data collected from the digitizer were stored on a file in both raw and normalized form, and the level of confidence to be expected in the normalized data is available to the user. These capabilities are achieved by three routines which set the transient digitizer for operation in the repetitive or single-sweep mode, unload raw data from the R7912 memory, and normalize raw data for signal processing or plotting. ERA

N78-28838# Sandia Labs., Albuquerque, N. Mex.
DPLIB.1: A LIBRARY OF DATA PROCESSING ROUTINES FOR THE PDP11 COMPUTER
Lee Toliver Feb. 1978 15 p refs Supersedes RS-9624/037
(Contract EY-76-C-04-0789)
(SAND-78-0039; RS-9624/037) Avail: NTIS HC A02/MF A01

This library was created for use in the development of user commands for the Applicon Graphic System. Data processing routines in the library can be called by PDP11 assembly language or FORTRAN programs. ERA

N78-28839# Idaho National Engineering Lab., Idaho Falls.
USER'S DESCRIPTION OF SECOND-ORDER ERROR PROPAGATION (SOERP) COMPUTING CODE FOR STATISTICALLY INDEPENDENT VARIABLES
N. D. Cox and Charles F. Miller Feb. 1978 20 p refs
(Contract EY-76-C-07-1570)
(TREE-1216) Avail: NTIS HC A02/MF A01

The development and use of second-order error propagation equations for the first four moments of a function of independently distributed random variables are discussed. The implementation of a computer code (SOERP) for solving these equations with up to 30 component variables is also presented. ERA

N78-28840# California Univ., Livermore. Lawrence Livermore Lab.
POST-PROCESSING OF MASTER CONTROL OUTPUT: A DESCRIPTION AND EXPLANATION OF TWO TRIX ALTER FILES
R. W. Kuhn, Keith W. Johnson, and Hank Moll 30 Jan. 1978 27 p
(Contract W-7405-eng-48)
(UCID-17739) Avail: NTIS HC A03/MF A01

A guide for users of the master control data base management system in preparing their output for publications is provided. It is not a comprehensive manual, nor are the TRIX alter files described general purpose routines, although some flexibility can be obtained by modifying them to satisfy particular requirements. The work described takes advantage of useful features in TRIX TRIX/RED and REDPP. By creating alter files which post-process normal output, these features are provided with a minimum of inconvenience to users. ERA

N78-28841# California Univ., Livermore. Lawrence Livermore Lab.
DESIGN AND IMPLEMENTATION OF A HIGH-LEVEL LANGUAGE FOR A PROGRAMMABLE FRAME BUFFER
D. R. Faul 29 Oct. 1977 129 p refs
(Contract W-7405-eng-48)
(UCID-17745) Avail: NTIS HC A06/MF A01

The language provided the facilities of a symbolic machine language, yet displayed high level block and control structure. The hardware peculiarities of the programmable picture processor (PPP), the programmable module of the frame buffer, and how the language design compensates for its restriction and utilizes its special characteristics are described. The implementation of the language was structured around the use of a syntax analyzer/parser generator program for SLR(1) and LALR(1) grammars. Translated code was compared to hand code for a representative PPP program. The results indicated the language allowed quick, concise, and readable PPP programming. The translated programs were also compact in storage and reasonably efficient in execution time compared to hand code. A language description, implementation description, and hardware summary are included in separate appendices. ERA

N78-28842# California Univ., Livermore. Lawrence Livermore Lab.
GEARV AND GEARST: VECTORIZED ORDINARY DIFFERENTIAL EQUATION SOLVERS FOR THE 7600 AND STAR COMPUTERS
D. B. Morris, A. C. Hindmarsh, and P. F. Dubois Dec. 1977 40 p refs
(Contract W-7405-eng-48)
(UCID-30119-Rev-1) Avail: NTIS HC A03/MF A01

GEARV and GEARST are packages of subroutines for the numerical solution of systems of ordinary differential equations, given the initial values. Both are vectorized versions of the GEAR package, and are good for both stiff and nonstiff systems. Each package contains both the implicit Adams methods and the backward differentiation formulas, or the method of GEAR, as options. GEARV is written for the CDC 7600 computer, with the use of STACKLIB and vector language features of the CHAT compiler at LLL. GEARST is written for the CDC STAR-100 computer, with the FENIX compiler. ERA

N78-28843# Sandia Labs., Albuquerque, N. Mex.
SLEIGN: AN EIGENVALUE--EIGENFUNCTION CODE FOR STURM-LIOUVILLE PROBLEMS
P. B. Bailey Jan. 1978 31 p refs
(Contract EY-76-C-04-0789)
(SAND-77-2044) Avail: NTIS HC A03/MF A01

A code is presented for the computation of eigenvalues and eigenfunctions of Sturm-Liouville problems of the form (pPSI)' + (q + lambda r)PSI = 0 on (a,b), with A1PSI(a) + A2p(a)PSI'(a) = 0 and B1PSI(b) + B2p(b)PSI'(b) sub 0. Infinite intervals and other kinds of singularities are handled completely automatically. The accuracy of the computed eigenvalue is realistically estimated. In addition to describing the basic algorithms employed in the code this report also explains, with examples, how the code is used. A short summary of its performance on a representative set of problems is also included. ERA

N78-28844# Sandia Labs., Albuquerque, N. Mex.
MATHEMATICAL PROGRAMMING UPDATING METHOD USING MODIFIED GIVENS TRANSFORMATIONS AND APPLIED TO LP PROBLEMS: A USER'S GUIDE FOR SLPMG ()
R. J. Hanson and J. A. Wisniewski Mar. 1978 32 p refs
(Contract EY-76-C-04-0789)
(SAND-77-2032) Avail: NTIS HC A03/MF A01

An efficient and numerically stable method is presented for the problem of updating an orthogonal decomposition of a matrix of column (or row) vectors. The fundamental idea was to add a column (or row) analogous to adding an additional row of data in a linear least squares problem. A column (or row) was dropped by a formal scaling with the imaginary unit, followed by least squares addition of the column (or row). The elimination process for the procedure was successive application of the Givens transformation in modified (more efficient)form. These ideas are illustrated with an implementation of the revised simplex method.

The algorithm is a general purpose one that does not account for any particular structure or sparsity in the equations. Some suggested computational tests for determining signs of various controlling parameters in the revised simplex algorithm are mentioned. A simple means of constructing test cases and some sample computing times are presented. ERA

N78-28845# Los Alamos Scientific Lab., N. Mex.
COMPUTER GRAPHICS FOR EXTRACTING INFORMATION FROM DATA
R. K. Lohrding, M. M. Johnson, and D. E. Whiteman 1978 22 p refs Presented at 11th Symp. on the Interface of Computer Sci. and Statistics, Raleigh, N. C., 6 Mar. 1978
(Contract W-7405-eng-36)
(LA-UR-77-3004; Conf-780317-2) Avail: NTIS HC A02/MF A01

Computer graphics which are useful for displaying and analyzing data are presented. Many classical and several newly developed graphical techniques in statistical data analysis are presented for small univariate and multivariate data sets. These include histograms, empirical density functions, pie charts, contour plots, a discriminant analysis display, cluster analysis, Chernoff faces, Andrews' sine curves, three dimensional plots, and probability plots. Recent advances in data collection technology and computer data base management systems have made it imperative to utilize computer graphics for large data sets. Several innovative graphical techniques are presented to handle this situation. Spatial relationships among the data (particularly geographic data) are difficult to conceptualize. Several cartographic techniques are presented which enhance the understanding of these spatial relationships within the data. ERA

N78-28846# Ames Lab., Iowa.
PROGRAMMER'S GUIDE FOR DISKORG: THE DISK ORGANIZATION SUBSYSTEM FOR THE PDP-15 COMPUTER
K. R. Brobst Dec. 1977 47 p refs
(Contract W-7405-eng-82)
(IS-4312) Avail: NTIS HC A03/MF A01

The disk organization package used with the PDP-15 computer is described. The directory and data set structure are described. Algorithms are given for the individual routines in the package. ERA

N78-28847# Oak Ridge Gaseous Diffusion Plant, Tenn. Computing Applications Dept.
ROUTINES FOR INTERPOLATION USING CUBIC SPLINES AND PSEUDOSPLINES
J. E. Park Oct. 1977 54 p refs Sponsored by DOE
(K/CSD/TM-6) Avail: NTIS HC A04/MF A01

With the continuity of the first derivative at the knots as a unifying concept, the equation sets describing two cubic splines are developed. The resulting systems of linear equations have tridiagonal coefficient matrices; FORTRAN routines to generate these matrices are presented. Several interpolation problems are solved and the solutions are discussed. ERA

N78-28848# Research Inst. of National Defence, Stockholm (Sweden). Huvudavdelning 5.
UDSIM - A COMPUTER PROGRAM FOR INVESTIGATION OF THE SMALL-SAMPLE PROPERTIES OF THE UP-AND-DOWN METHOD
Karl-Hugo Eriksson, Bertil Hedlund, and Ola Hertzberg Nov. 1977 31 p refs
(FOA-C-54019-H2) Avail: NTIS HC A03/MF A01

Research concerning the estimation of parameters of quantal response curves is described. The up-and-down method is an often used sequential technique for estimating such curves. Several estimators have been suggested in connection with the up-and-down technique. Some of these methods were investigated by a Monte-Carlo method; one of the computer programs used, UDSIM, is described. The program is written in FORTRAN 4 for the DEC-10 computer. ESA

N78-28849# Koninklijke/Shell-Laboratorium, Amsterdam (Netherlands).
A CASE STUDY IN STRUCTURED PROGRAMMING: CONSTRUCTION OF A COMPILER FOR ARITHMETIC ASSIGNMENT STATEMENTS
F. Deckers May 1976 89 p refs 3 Vol.
(AMSR.0022.76) Avail: NTIS HC A05/MF A01

The practical applicability of structured programming to software development was studied. Parts of this new methodology can be formulated in simple rules, such as the avoidance of goto statements; however, the more essential aspects, such as stepwise decomposition of modules and verification of formalized requirements definitions, are less amenable to description in the form of a recipe and have to be communicated mainly by examples. The development of a program to satisfy a request for a compiler for arithmetic assignment statements is described in detail. The compiler consists of approximately 1500 lines of SHELTRAN code. A formal requirement definition for the main modules is given and the modules are shown to implement these requirements correctly. Furthermore it is argued that such a description should constitute part of the documentation of any well-structured program in order to facilitate maintenance. Author (ESA)

N78-28850# Koninklijke/Shell-Laboratorium, Amsterdam (Netherlands).
A CASE STUDY IN STRUCTURED PROGRAMMING: CONSTRUCTION OF A COMPILER FOR ARITHMETIC ASSIGNMENT STATEMENTS. APPENDIX 1: COMPILER LISTING IN SHELTRAN
F. Deckers 1976 60 p 3 Vol.
(AMSR.0022A.76-App-1) Avail: NTIS HC A04/MF A01
For abstract, see N78-28849.

N78-28851# Koninklijke/Shell-Laboratorium, Amsterdam (Netherlands).
A CASE STUDY IN STRUCTURED PROGRAMMING: CONSTRUCTION OF A COMPILER FOR ARITHMETIC ASSIGNMENT STATEMENTS. APPENDIX 2: COMPILATION OF SOME SAMPLE STATEMENTS
F. Deckers 1976 20 p 3 Vol.
(AMSR.0022B.76-App-2) Avail: NTIS HC A02/MF A01
For abstract, see N78-28849.

N78-28117*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE LOVASZ BOUND AND SOME GENERALIZATIONS
R. J. McEliece, E. R. Rodemich, and H. C. Rumsey, Jr. *In its* The Deep Space Network 15 Jun. 1978 p 133-146 refs
(For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 09B

N78-28118*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ALGORITHM FOR GENERATING AN m-ARY SUMMATION TREE
M. Sievers *In its* The Deep Space Network 15 Jun. 1978 p 147-151 (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 09B

N78-28121*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A NEW HYBRID ALGORITHM FOR COMPUTING A FAST DISCRETE FOURIER TRANSFORM
I. S. Reed (Univ. of S. Calif., Los Angeles) and T. K. Truong *In its* The Deep Space Network 15 Jun. 1978 p 172-185 refs (For primary document see N78-28108 19-12)
(Grant AF-AFOSR-2798-75)
Avail: NTIS HC A14/MF A01 CSCL 09B

N78-28123*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A NEW ALGORITHM FOR COMPUTING PRIMITIVE ELEMENTS IN GF q SQUARE
I. S. Reed (Univ. of S. Calif., Los Angeles), T. K. Truong, and R. L. Miller *In its* The Deep Space Network 15 Jun. 1978 p 190-196 refs (For primary document see N78-28108 19-12)
Avail: NTIS HC A14/MF A01 CSCL 09B

N78-29035# Joint Publications Research Service, Arlington, Va.
DIRECTIONS OF EFFECTIVE DEVELOPMENT OF COMPUTER SOFTWARE
Ivan Todorov *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 37-40 ref Transl. into ENGLISH from Mekh. Avtomatiz. Proizv. (Moscow), no. 4, 1978 p 54-55
(For primary document see N78-29032 19-99)
Copyright. Avail: NTIS HC A06/MF A01

62 COMPUTER SYSTEMS

Includes computer networks.

N78-28852 Texas Univ. at Austin.
DEGENERACY ASPECTS AND MINICOMPUTER APPLICATIONS OF NETWORK-RELATED PROBLEMS Ph.D. Thesis
Joyce Johnson Elam 1977 194 p
Avail: Univ. Microfilms Order No. 78-07292

A major theoretical and computational problem of network and mathematical programming algorithms -- namely, the problem of how to effectively exploit and circumvent degeneracy, is addressed. A new class of algorithms is developed for solving transshipment, generalized transshipment, and singularly constrained transshipment problems which exhibit the following properties. Bases examined by each algorithm are restricted to have a certain topological structure. Effectively combining and integrating the technology of minicomputers and optimization techniques are considered. The feasibility of implementing a particular class of network algorithms, namely shortest path algorithms, on typical minicomputers is demonstrated. Two distinct shortest path algorithms were tested on four computer systems using a common set of test problems. Computational results are presented which verify the feasiblity of implementing these algorithms in a minicomputer environment. Dissert. Abstr.

N78-28853# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTER SCIENCES RESEARCH STATUS REPORT
R. W. Watson 3 Feb. 1978 50 p refs
(Contract W-7405-eng-48)
(UCID-17720) Avail: NTIS HC A03/MF A01

Computer science research at LLL funded by the Department of Energy, Division of Basic Energy Sciences during FY 77 focused on computer networks, primarily local networks. The work in this area centered in four areas: modeling and simulation, protocol development for local networks, local network statistics gathering system, and ERDA/DOE network investigators group participation. The work in each of these areas is briefly summarized. Slides and reports of interest are included. In addition to the network research work, two specialized architecture studies are included: performance studies for array processors, and a study of data flow architecture. ERA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N78-28854 Colorado State Univ., Fort Collins.
IDENTIFICATION AND ADAPTIVE CONTROL VIA IDENTIFICATION Ph.D. Thesis
Eliezer Fogel 1977 181 p
Avail: Univ. Microfilms Order No. 78-07424

The problem of optimally controlling a linear system with unknown parameters is considered. This problem entails the study of two subjects: (1) performance of identification algorithms, and (2) performance of the control algorithm. A general dynamic (sequential) algorithm is derived which facilitates the construction of different identification algorithms by a choice of an nx1 vector subject to simple constraints. This vector, properly chosen, yields a convergent identification algorithm for stable-unstable white noise driven models. Using the estimates of the system parameters and the deviation of these estimates from the true parameters, the control algorithm is constructed. Finally, via game theory, a sensitivity function is analyzed to yield an optimal control scheme. The new algorithm is shown to perform significantly better than previous algorithms discussed in the literature. The present algorithm is shown to be insensitive to the error of the estimations and is relatively simple. Dissert. Abstr.

N78-28855# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A BAYESIAN APPROACH TO EDGE DETECTION IN IMAGES
N. D. A. Mascarenhas and L. O. C. Prado Mar. 1978 31 p refs Submitted for publication
(INPE-1206-PE/117) Avail: NTIS HC A03/MF A01

New statistical techniques for the edge detection problem in images are developed. The image is modeled by signal and noise which are independent, additive, Gaussian and autorregressive in two dimensions. The optimal solution, in terms of statistical decision theory, leads to a test which decides among multiple composite, overlapping hypotheses. A computationally attractive suboptimal test, involving non-overlapping hypotheses, is proposed. Results are presented with simulated data and real satellite images. A comparison with standard gradient techniques is made. Author

N78-28856# Southern Methodist Univ., Dallas, Tex. Dept. of Industrial Engineering and Operations Research.
APPROXIMATION TECHNIQUES IN THE SOLUTION OF QUEUEING PROBLEMS
U. Narayan Bhat, Martin J. Fischer, and Mohamed. A. Shalaby Mar. 1978 36 p refs
(Contract N00014-75-C-0517)
(AD-A053499; IEOR-76017) Avail: NTIS HC A03/MF A01 CSCL 12/2

In the study of complex queueing systems analysis techniques aimed at providing exact solutions become ineffective. Approximation techniques provide an attractive alternative in such cases. This paper gives an overview of different types of approximation techniques available in the literature and points out their relative merits. Also the need for proper validation procedures of approximation techniques is emphasized. Author (GRA)

N78-28857# Southern Methodist Univ., Dallas, Tex. Dept. of Industrial Engineering and Operations Research.
AN APPROXIMATE ANALYSIS OF A MULTI-SERVER FINITE QUEUE WITH HETEROGENEOUS CUSTOMERS
U. Narayan Bhat Oct. 1977 22 p refs
(Contract N00014-75-C-0517)
(AD-A053498; IEOR-77020) Avail: NTIS HC A02/MF A01 CSCL 12/2

This paper presents a simple approach for the study of the following two types of multiserver finite queueing systems each with two classes of customers demanding service with different arrival and service rates: (1) Customers belonging to one class have priority over the other and the number of low priority customers that may be present in the system at any time is restricted. Customers blocked from entering service at any time are cleared from the system. (2) Customers belonging to one class are cleared when blocked (loss system) and customers belonging to the other class are buffered (delay system) under such circumstances. Furthermore, the number of customers belonging to the loss system demanding service at any time is restricted. Author (GRA)

N78-28858# Southern Methodist Univ., Dallas, Tex. Dept. of Operations Research and Engineering Management.
BOUNDS AND APPROXIMATIONS FOR A GENERALIZED MEASURE OF PERFORMANCE IN THE G/N/1/N QUEUE
Mohamed A. Shalaby and U. Narayan Bhat Feb. 1978 34 p refs
(Contract N00014-75-C-0517)
(AD-A053497; OREM-78005) Avail: NTIS HC A03/MF A01 CSCL 12/2

A generalized measure of performance is defined as a weighted combination of the ergodic queue length distribution where the weights are general functions of the system parameters. The paper presents a sequence of upper and lower bounds for this measure of performance in the G/M/1/N queue with FIFO discipline. The bounds are used to derive a sequence of approximations with bounded errors. The upper and lower bounds are shown to converge to their corresponding exact values. The technique used is based on the imbedded Markov chain analysis and considers only subsets of the steady state equations to derive the bounds. Initial computational experience is encouraging and has indicated that the approximations are viable for heavy and medium traffic conditions Author (GRA)

N78-28859# Southern Methodist Univ., Dallas, Tex. Dept. of Operations Research and Engineering Management.
ON A METHODOLOGY FOR THE ANALYSIS OF MULTI-ARRIVAL QUEUEING SYSTEMS Final Report, 1 Jan. 1976 - 31 Mar. 1978
31 Mar. 1978 12 p refs
(Contract N00014-75-C-0517)
(AD-A053496) Avail: NTIS HC A02/MF A01 CSCL 12/2

Research work was carried out in the following areas: (1) a generalized measure of performance, (2) queueing systems with varying number of servers, (3) approximation in queueing systems and (4) queueing theory applications in computer systems. L.S.

N78-28860# Orincon Corp., La Jolla, Calif.
DESIGN OF PRACTICAL CONTROL ALGORITHMS FOR NONLINEAR STOCHASTIC SYSTEMS Interim Report
Daniel L. Alspach 31 Mar. 1978 10 p refs
(Contract F44620-75-C-0023; AF Proj. 2304)
(AD-A053611; OC-R-78-0023-2; AFOSR-78-0845TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This interim report summarizes a continuation of the investigation into the use of digital nonlinear filters in conjunction with deterministic control algorithms. The problem of stabilization and control of nonlinear stochastic systems observed by noisy measurement data arises in many Air Force systems. Inherent in this problem is the problem of processing noise contaminated measurement data to obtain accurate estimates of the state of the system. If it is possible to estimate the state of the system accurately, then well-known classical deterministic control techniques may often be used to give adequate system performance. This approach will greatly reduce the complexity of the control algorithm over that required by a truly optimal stochastic control policy. On the other hand, the use of recently developed filtering techniques in place of the simpler linearized or extended Kalman filter can greatly increase the accuracy of the state estimates and, thereby, improve system performance and alleviate divergence problems. Author (GRA)

N78-28861*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
ANALYSIS AND IN-SIMULATOR EVALUATION OF DISPLAY AND CONTROL CONCEPTS FOR A TERMINAL CONFIGURED VEHICLE IN FINAL APPROACH IN A WINDSHEAR ENVIRONMENT Final Report
William H. Levison Washington NASA Aug. 1978 98 p refs
(Contract NAS1-13842)
(NASA-CR-3034) Avail: NTIS HC A05/MF A01 CSCL 12B

Display Control configurations for the Terminal configured Vehicle in approach to landing situations were analyzed. A pilot/vehicle model was used to compare with a real time simulation study. Model results are presented and extended for the approach task during wind shear and random turbulence environments. In general, model results of performance trends matched those obtained experimentally. J.M.S.

N78-28862# Florence Univ. (Italy). Ist. di Elettronica.
COMPUTER VOICE OUTPUT
G. Francini 1977 7 p Presented at the Seminar on Elec. Safety in Hazardous Environ., London, 7 Dec. 1975
(R-1-77) Avail: NTIS HC A02/MF A01

A discourse on the use, aspects, and problems of computers in the synthesis of speech with the aim of creating a voice output for the computer itself from written text is given. ESA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N78-28863 Stanford Univ., Calif.
THE COMPUTATION OF EQUILIBRIA BY PATH METHODS Ph.D. Thesis
Thomas Richard Elken 1978 224 p
Avail: Univ. Microfilms Order No. 78-08786

The problem considered is that of finding a solution to a system of nonlinear equations subject to some auxiliary constraints. As an important special case, algorithms for solving the Walrasian general equilibrium problem of economics are discussed. The methods considered are called path methods for solving equations. A rigorous proof of convergence is given for an algorithm which implements a general path method. A model is described for an economy in which the utility functions are piecewise linear and the consumption and production sets are polyhedral. It is shown that an equilibrium for this economy is the solution to a system of bilinear equations subject to certain linear inequality and complementarity constraints. Two approaches are discussed for computing equilibria for such economies. The first is the bilinear complementarity algorithm and the second is the homotopy retraction algorithm. Convergence proofs are given for both methods using the general theory for path methods described above. Dissert. Abstr.

N78-28864 Stanford Univ., Calif.
DECOMPOSABILITY IN FIXED POINT COMPUTATION Ph.D. Thesis
Daniel Solow 1978 128 p
Avail: Univ. Microfilms Order No. 78-08845

Proofs developed into algorithms which search for fixed points on unbound regions are studied. One result is an efficient complementary pivot algorithm for handling this problem. The second major contribution is a general structure on fixed point problems which, when present, enables one to work in a lower dimensional space. It is shown that the general constrained optimization problem may sometimes be formulated as a fixed point problem possessing this property. Dissert. Abstr.

N78-28865*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESCRIPTION OF A COMPUTER PROGRAM AND NUMERICAL TECHNIQUES FOR DEVELOPING LINEAR PERTURBATION MODELS FROM NONLINEAR SYSTEMS SIMULATIONS
James E. Dieudonne Jul. 1978 41 p refs
(NASA-TM-78710; L-12114) Avail: NTIS HC A03/MF A01 CSCL 12A

A numerical technique was developed which generates linear perturbation models from nonlinear aircraft vehicle simulations. The technique is very general and can be applied to simulations of any system that is described by nonlinear differential equations. The computer program used to generate these models is discussed, with emphasis placed on generation of the Jacobian matrices, calculation of the coefficients needed for solving the perturbation model, and generation of the solution of the linear differential equations. An example application of the technique to a nonlinear model of the NASA terminal configured vehicle is included. J.A.M.

N78-28866# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
WEIGHTED MIN-MAX AND MAX-MIN LOCATION PROBLEMS: FINITE AND POLYNOMIALLY BOUNDED ALGORITHMS
R. Chandrasekaran (Univ. of Tex. at Dallas) and Marcos J. A. P. Pacca Apr. 1978 16 p refs Submitted for publication
(INPE-1208-PE/119) Avail: NTIS HC A02/MF A01

The difficulties encountered in solving the one-facility minmax location problem with different weights can be overcome by taking advantage of the special structure of the problem. A finite and polynomially bounded algorithm is developed. A.R.H.

N78-28867# Stanford Univ., Calif. Dept. of Computer Science.
MATHEMATICAL TYPOGRAPHY
Donald E. Knuth Feb. 1978 72 p refs
(Contract N00014-76-C-0330; Grant NSF MCS-72-03752)
(AD-A054143; STAN-CS-78-648) Avail: NTIS HC A04/MF A01 CSCL 14/5

The old and well-developed traditions of typesetting of mathematical symbols have become too expensive. A method needs to be devised for unambiguously specifying mathematical manuscripts in such a way that they can easily be manipulated by machines. Such languages, when properly designed, can be learned quickly by authors and their typists, yet manuscripts in

this form will lead directly to high quality plates for the printer with little or no human intervention. A second step in the solution makes use of classical mathematics to design the shapes of the letters and symbols themselves. It is possible to give a rigorous definition of the exact shape of the letter 'a', for example, in such a way that infinitely many styles (bold, extended, sans-serif, italic, etc.) are obtained from a single definition by changing only a few parameters. When the same is done for the other letters and symbols, we obtain a mathematical definition of type fonts, a definition that can be used on all machines both now and in the future. The main significance of this approach is that new symbols can readily be added in such a way that they are automatically consistent with the old ones. GRA

N78-28868# Sandia Labs., Albuquerque, N. Mex.
COMMON-CAUSE ANALYSIS USING SETS
R. B. Worrell and D. W. Stack Dec. 1977 15 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1832) Avail: NTIS HC A02/MF A01

Common-cause analysis was developed for studying the behavior of a system that is affected by special conditions and secondary causes. Common-cause analysis is related to fault tree analysis. Common-cause candidates are minimal cut sets whose primary events are closely linked by a special condition or are susceptible to the same secondary cause. It is shown that common-cause candidates can be identified using the Set Equation Transformation System (SETS). A Boolean equation is used to establish the special conditions and secondary cause susceptibilities for each primary event in the fault tree. A transformation of variables (substituting equals for equals), executed on a minimal cut set equation, results in replacing each primary event by the right side of its special condition/secondary cause equation and leads to the identification of the common-cause candidates. ERA

N78-28869# Royal Netherlands Meteorological Inst., De Bilt.
ITERATIVE METHODS FOR SOLVING ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS [ITERATIEVE METHODEN VOOR HET OPLOSSEN VAN ELLIPTISCHE PARTIELE DIFFERENTIAALVERGELIJKINGEN]
S. J. Bijlsma 1977 34 p refs In DUTCH; ENGLISH summary
(KNMI-WR-77-8) Avail: NTIS HC A03/MF A01

Various iterative methods for solving the Poisson and Helmholtz equations are surveyed including the Richardson, Jacobis, Chebyshev, Gauss-Seidel, Young, Sheldon, and Peachman-Rachford methods. A number of these techniques was applied to solve the Poisson and Helmholtz equations on a regular octagonal region. Concerning the Helmholtz equation the application of point-iterative methods is preferable if the Helmholtz coefficient is sufficiently large. For each method the number of iterations needed to reduce a given initial error by different reduction factors is presented. Also, the iteration time ratio with respect to the point successive overrelaxation method is given. ESA

N78-28870# Royal Netherlands Meteorological Inst., De Bilt.
DIRECT METHODS FOR SOLVING ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS [DIRECTE METHODEN VOOR HET OPLOSSEN VAN ELLIPTISCHE PARTIELE DIFFERENTIAALVERGELIJKINGEN]
S. J. Bijlsma 1977 22 p refs In DUTCH; ENGLISH summary
(KNMI-WR-77-9) Avail: NTIS HC A02/MF A01

Direct methods for solving Poisson's equation on a rectangle, such as block methods, cyclic reduction methods, matrix decomposition methods, and Fourier series methods, are surveyed. Extensions of these methods to more general domains given by Buzbee, Dorr, George, and Golub (1971), are also briefly discussed. Author (ESA)

N78-28871# Koninklijke/Shell-Laboratorium, Amsterdam (Netherlands).
AN OPTIMUM DECOMPOSITION METHOD FOR THE ITERATIVE SOLUTION OF NONLINEAR EQUATIONS
Aram K. Kevorkian Jun. 1976 34 p refs
(AMSR.0027.76) Avail: NTIS HC A03/MF A01

An iterative algorithm is presented which exploits a structure of an irreducible system of n nonlinear equations in n unknowns in such a way that at each iteration only a Jacobian of minimum order theta, where 1 smaller than or equal to theta smaller or equal to n-1 is generated and, subsequently, a system of theta linear algebraic equations in theta unknowns is solved. It is shown that the iterative process converges locally and that the behavior of convergence is quadratic. It is further shown that at each iteration an optimum structure can be imposed on an irreducible system of nonlinear equations. The exploitation of an optimum structure both enhances the local quadratic convergence property of the presented iterative algorithm and improves its numerical accuracy. The effectiveness of the iterative algorithm is demonstrated by computer results and by comparison with other quadratically convergent algorithms. Author (ESA)

N78-28872# Koninklijke/Shell-Laboratorium, Amsterdam (Netherlands).
ALTRIGONS AND NALTRIGONS OF AN ADJOINT GRAPH. PART 1: A NOTION FOR BLOCK-TRIANGULAR DECOMPOSITION WITHOUT A SYSTEM OF DISTINCT REPRESENTATIVES
Aram K. Kevorkian and Arie P. vanderStroom Sep. 1976 22 p refs
(AMSR.0040.76) Avail: NTIS HC A02/MF A01

The notion of alternatingly triangulated polygon (altrigon) and nonalternatingly triangulated polygon (naltrigon) of an adjoint graph is introduced. It is shown how this notion permits the block-triangular decomposition of reducible matrices without the need for the construction of a system of distinct representatives. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N78-28873 George Washington Univ., Washington, D. C.
ON MINIMUM VON MISES STATISTIC ESTIMATORS Ph.D. Thesis
Lowell Elfenbein 1978 139 p
Avail: Univ. Microfilms Order No. 7810146

The method is essentially a modeling technique: a parametric model is fitted to the data by minimizing the goodness-of-fit statistic. Modified Minimum Von Mises Statistics (MVMS) estimators, which are asymptotically equivalent to MVMS estimators and are easier to compute. The main results for modified MVMS estimators are that they are unique, strongly consistent when the parametric model is true, asymptotically normal whether or not the parametric model is true, and continuous with respect to the Prokhorov metric; as a result of this continuity property, modified MVMS estimators are robust against small changes in the empirical distribution Gn.. Two classes of robust modified MVMS estimators for the exponential distribution are introduced. The Monte Carlo results show that certain of the modified MVMS estimators outperform other robust estimators in closely matching the tail of a distribution only approximately exponential. Dissert. Abstr.

N78-28874 Kansas State Univ., Manhattan.
THE DOUBLY NONCENTRAL DISTRIBUTION OF WILKS' LAMBDA STATISTIC AND ITS APPLICATION TO MULTIVARIATE ANALYSIS OF VARIANCE Ph.D. Thesis
Dhanwant Singh Gill 1977 67 p
Avail: Univ. Microfilms Order No. 7811418

Work was done to develop the multivariate distribution theory, namely, doubly noncentral generalized multivariate beta distribution and doubly noncentral distribution of Wilks lambda statistic which is needed to construct the conditional distribution of the test statistic to be used to provide a mathematical justification for the commonly used approximate test procedure in multivariate analysis of variance. It was found that by averaging out the conditional distribution of the test statistic in the presence of plot-effects, for a fixed assignment of treatments, under the null hypothesis, with respect to the permutation distribution did give us, in the linear case the usual central distribution of Wilks'

lambda test statistic used for the multivariate analysis of variance. Dissert. Abstr.

N78-28875 George Washington Univ., Washington, D. C.
A TIME SERIES ANALYSIS OF SOME SIMULTANEOUS EQUATION STOCHASTIC MODELS Ph.D. Thesis
Barry David Nussbaum 1978 72 p
Avail: Univ. Microfilms Order No. 78-08655

A goal here is to demonstrate the advantages of using the techniques of time series analysis for a more detailed and rigorous understanding of the behavior of simultaneous equation stochastic models. Specifically, the basic cobweb model of economics is considered; it is shown that this model could be viewed as a simple time series process. A contribution of this study is the formal introduction of the concept of minimum mean square error consistency. Several well-known variations of the cobweb model are evaluated in the light of their adherence to the concept of consistency and it is shown that in all but a few pathological cases the variations are not minimum mean square error consistent. Dissert. Abstr.

N78-28876# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
EXIT PROBABILITIES AND OPTIMAL STOCHASTIC CONTROL Interim Report
Wendell H. Fleming Feb. 1978 38 p refs
(Grants AF-AFOSR-3063-76; NSF MCS-76-07247; AF Proj. 2304)
(AD-A053659; AFLSR-78-0753TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper is concerned with Markov diffusion processes which obey stochastic differential equations depending on a small parameter E. The parameter enters as a coefficient in the noise term of the stochastic differential equation. The Ventcel-Freidlin estimates give asymptotic formulas (as E approaches 0) for such quantities as the probability of exit from a region D through a given portion N of the boundary increment of D, the mean exit time, and the probability of exit by a given time T. A new method to obtain such estimates is given, using ideas from stochastic control theory. GRA

N78-28877# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
ON THE DISTRIBUTION OF QUANTILES OF RESIDUALS IN A LINEAR MODEL Interim Report
Raymond J. Carroll Mar. 1978 10 p refs
(Grant AF-AFOSR-2796-75)
(AD-A053597; MIMEO-SER-1161; AFOSR-78-0819TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The representation for quantiles discussed by Bahadur (1966) and Ghosh (1971) is extended to quantiles from the residuals in a linear model. As an application, a robust test for symmetry is proposed. Author (GRA)

N78-28878# Florence Univ. (Italy). Facolta d'Ingegneria.
ON THE IDENTIFICATION OF NONLINEAR PROCESSES BY STOCHASTIC METHODS [SUR L'IDENTIFICATION DE PROCESSUS NON LINEAIRES PAR DES METHODES STOCHASTIQUES]
Claude Lobry (Bordeaux Univ.) 1977 8 p refs In FRENCH
Presented at the Seminary of the Ist. di Mat. Appl., Florence, 15 Jul. 1977
Avail: NTIS HC A02/MF A01

The identification of nonlinear deterministic systems by standard stochastic methods is discussed. An analysis of an example of Wong and Zakai shows that this approach poses serious problems which are of geometric rather than probabilistic nature. The difficulties arise because for simplicity the stochastic processes are generated via stochastic differential equations by Wiener processes. The latter are an idealization of reality; an adequate theorem for the nonlinear case does not exist. ESA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N78-28879 Cornell Univ., Ithaca, N. Y.
ON GAME THEORY AND COALITION FORMATION Ph.D. Thesis
Prakash Pundalik Shenoy 1977 142 p
Avail: Univ. Microfilms Order No. 78-07796

In one approach, the formulation of coalitions is modelled as an abstract game. A more descriptive solution concept reflecting the dynamic aspects of bargaining--called the dynamic solution--is proposed. The core and the dynamic solution are then used to analyze the abstract game formulation of the problem of coalition formation. The predictions of the abstract game models depend on the particular payoff solution concept used. The predictions of these models are then studied for the case of n-person cooperative games with side payments using various payoff solution concepts. In another approach, coalition formation is viewed as a bargaining process where the players are allowed to raise objections and counter objections in the same manner as in the Aumann-Maschler bargaining sets. Two classical theories of coalition formation are mathematically analyzed and compared with the predictions of the abstract game models under the same assumptions. Dissert. Abstr.

N78-28880 Johns Hopkins Univ., Baltimore, Md.
IDENTIFICATION AND APPROXIMATION OF NONLINEAR SYSTEMS BASED ON FREQUENCY RESPONSE DATA Ph.D. Thesis
Edward Michael Wysocki 1978 127 p
Avail: Univ. Microfilms Order No. 78-06283

The identification and approximation problems based on steady-state frequency response measurements are considered for a class of nonlinear systems. A nonlinear system in the class is composed of the parallel additive connection of cascade arrangements of linear systems and static power nonlinearities. The identification methods which employ amplitude-phase measurements of the various harmonics are shown to require less data then the existing method. With a minimum phase restriction on the various linear systems in the structure, the procedures are extended to the case of only amplitude measurements. A procedure is developed by which a system in this class can be used in the least approximation of the steady-state frequency response of a wide class of nonlinear systems. The approximation is calculated through the adjustment of free parameters in a partially determined structure. Dissert. Abstr.

N78-28881 George Washington Univ., Washington, D. C.
THE MEASUREMENT OF VALUE IN ENGINEERING DESIGN: A NORMATIVE PROCESS FOR ASSESSING THE UTILITY OF INTERDEPENDENT MULTIATTRIBUTE ALTERNATIVES Ph.D. Thesis
James Alan Lisnyk 1977 251 p
Avail: Univ. Microfilms Order No. 78-09205

Multiattribute utility theory is extended to cover the situation where attribute interdependence exists, the objective being to identify useful tests for attribute interdependence, and to develop practical methods for handling this situation in a static, deterministic environment. To assist in identifying instances where attribute interdependence exists, three quantitative tests were developed: an indifference between lotteries test, a certainty equivalent test, and an indifferent curve test. All three of these tests were mathematically derived from von Neumann and Morgenstern's axioms of rational behavior, which form the foundation of modern utility theory. Quantitatively, the experimental results indicated that all three procedures gave consistent and valid results, but that one of them, the mathematical composition rule procedure, was both easier and faster to use than the other two. This procedure was, therefore, judged to be the one best suited for use in complex decision problems involving interdependent attributes. Dissert. Abstr.

N78-28882# Yale Univ., New Haven, Conn. Cowles Foundation for Research in Economics.
PROBABILISTIC VALUES FOR GAMES
Pradeep Dubey and Robert James Weber 1 Nov. 1977 51 p refs
(Contract N00014-77-C-0518)
(AD-A053515; Discussion Paper-471) Avail: NTIS HC A04/MF A01 CSCL 12/1

Much attention has been given to methods for measuring

the value of playing a particular role in a n-person game. The study of various values is motivated by several considerations. One is to determine an equitable distribution of the wealth available to the players through their participation in the game. Another is to help an individual compare his prospects from participation in several games. A study of equitable distributions may shed light upon a player's prospects. However, a study of individual prospects need not yield any information concerning the relative fairness of various distributions of wealth. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N78-28883# Koninklijke/Shell-Laboratorium, Amsterdam (Netherlands).
THE PRINCIPAL MAXMIN DISTINCT REPRESENTATIVES ASSIGNMENT STRATEGY. PART 1: GENERAL THEORY
Aram K. Kevorkian Jun. 1976 25 p refs
(AMSR.0028.76) Avail: NTIS HC A02/MF A01

Given an irreducible matrix Y, a new assignment strategy is presented for the finding of permutation matrices P and Q such that in a block form of the matrix PYQ the condition numbers of the leading submatrix A and its Schur complement D-CA(-1)B are as small as possible relative to the l infinity-norm. The so-called principal maxmin distinct representatives assignment concept is a special case of an important combinatorial mathematics notion introduced by P. Hall more than forty years ago. Author (ESA)

N78-28884# Koninklijke/Shell-Laboratorium, Amsterdam (Netherlands).
A CONNECTION BETWEEN THE NOTIONS OF MINIMUM ESSENTIAL SET AND SYSTEM OF DISTINCT REPRESENTATIVES
A. K. Kevorkian and A. P. vanderStroom Jun. 1976 19 p refs
(AMSR.0029.76) Avail: NTIS HC A02/MF A01

A connection is established between a minimum essential set of the so-called adjoint graph of a family of subsets of a set and a system of distinct representatives for the family of subsets. The connection is shaped as a new graph-theoretic theorem concerning the existence of a system of distinct representatives. With regard to the computational complexity of constructing a minimum essential set, the result presented is of particular interest in that it shows that the problem of constructing a minimum essential set of adjoint graphs is polynomial-complete. Author (ESA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N78-28885# Sandia Labs., Albuquerque, N. Mex.
THERMAL DIFFUSIVITY MEASUREMENT OF TEMPERATURE SENSITIVE MATERIALS BY AN EXTENDED PULSE TECHNIQUE
A. B. Donaldson and B. D. Faubion (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.) 1977 8 p refs Presented at the 15th Intern. Thermal Conductivity Conf., Ottawa, Can., 24 Aug. 1977
(Contract EY-76-C-04-0789)
(SAND-77-0973; Conf-770847-5) Avail: NTIS HC A02/MF A01

Extended pulse effects, radial heat conduction effects, and surface heat loss effects were studied. The results are used to consider: (1) the regime of pulse times for which data reduction can be based on the instantaneous pulse model; (2) the regime of specimen diameter/thickness ratios for which radial conduction effects can be neglected (this consideration allows minimizing explosive mass and hence, the hazard); and (3) the estimation of the four front surface temperature during heating (so that ignition or decomposition temperatures are not reached). Also, the results of experiments with the explosives HNS and RDX are discussed. Data reduction is made by finding the values of thermal diffusivity and surface heat loss coefficients which minimize the sum of the squares deviation between the experimental response curve and the theoretical response curve. ERA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N78-28886*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY STUDY OF THE EFFECT OF THE TURBULENT FLOW FIELD AROUND COMPLEX SURFACES ON THEIR ACOUSTIC CHARACTERISTICS
W. A. Olsen and D. Boldman 1978 32 p refs Presented at the 11th Fluid and Plasma Dyn. Conf., Seattle, 10-12 Jul. 1978; sponsored by AIAA
(NASA-TM-78944; E-9691; AIAA-78-1123) Avail: NTIS HC A03/MF A01 CSCL 20A

Fundamental theories for noise generated by flow over surfaces exist for only a few simple configurations. The role of turbulence in noise generation by complex surfaces should be essentially the same as for simple configurations. Examination of simple-surface theories indicates that the spatial distributions of the mean velocity and turbulence properties are sufficient to define the noise emission. Measurements of these flow properties were made for a number of simple and complex surfaces. The configurations were selected because of their acoustic characteristics are quite different. The spatial distribution of the turbulent flow properties around the complex surfaces and approximate theory are used to locate and describe the noise sources, and to qualitatively explain the varied acoustic characteristics. L.S.

N78-28887*# Douglas Aircraft Co., Inc., Long Beach, Calif.
AIRFRAME NOISE OF THE DC-9-31 Final Report
A. B. Bauer and A. G. Munson Jul. 1978 54 p refs
(Contract NAS1-14696)
(NASA-CR-3027) Avail: NTIS HC A04/MF A01 CSCL 20A

Airframe noise measurements are reported for the DC-9-31 aircraft flown at several speeds and with a number of flap, landing gear, and slat extension configurations. The data are corrected for wind effects, atmospheric attenuation, and spherical divergence, and are normalized to a 1 meter acoustic range. The sound pressure levels are found to vary approximately as the fifth power of flight velocity. Both lift and drag dipoles exist as a significant part of the airframe noise. The sideline data imply that a significant side-force dipole exists only for the flap- and gear-down configurations; for others, the data imply the existence of only the lift and drag dipoles. The data are compared with airframe noise predictions using the drag element and the data analysis methods. Although some of the predictions are good, further work is needed to refine the methods, particularly for the flap- and gear-down configurations. Author

N78-28888# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
COMMUNITY NOISE EXPOSURE RESULTING FROM AIRCRAFT OPERATIONS. VOLUME 3: ACOUSTIC DATA ON MILITARY AIRCRAFT, AIR FORCE ATTACK/FIGHTER AIRCRAFT
Jerry D. Speakman, Robert G. Powell, and Robert A. Lee Feb. 1978 763 p ref
(AF Proj. 7231)
(AD-A053701; AMRL-TR-73-110-Vol-3) Avail: NTIS HC A99/MF A01 CSCL 01/2

This report presents the results of field test measurements to define the noise produced on the ground by military, fixed wing aircraft during controlled level flyovers and ground runups. For flight conditions, data are presented in terms of various acoustic measures over the range 200-25,000 feet minimum slant distance to the aircraft. For ground runups, data are presented as a function of angle and distance to the aircraft. All of the

data are normalized to standard acoustic reference conditions of 59 F temperature and 70% relative humidity. Noise data are presented in this Volume 3 for the following aircraft: A-7D, E; A-10A; A-37B; F-4C, D, E, F; F-5A, B; F-5E, F; F-15A; F-16A; F-104C, D, G; F-111A, E; F-111D, and F-111F. GRA

N78-28889# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
COMMUNITY NOISE EXPOSURE RESULTING FROM AIRCRAFT OPERATIONS. VOLUME 2: ACOUSTIC DATA ON MILITARY AIRCRAFT, AIR FORCE BOMBER/CARGO AIRCRAFT
Jerry D. Speakman, Robert G. Powell, and Robert A. Lee Nov. 1977 768 p ref
(AF Proj. 7231)
(AD-A053700; AMRL-TR-73-110-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 01/2

This report presents the results of field test measurements to define the single event noise produced on the ground by military, fixed wing aircraft during controlled level flyovers and ground runups. For flight conditions, data are presented in terms of various acoustic measures over the range 200-25,000 feet minimum slant distance to the aircraft. For ground runups, data are presented as a function of angle and distance to the aircraft. All of the data are normalized to standard acoustic reference conditions of 59 F temperature and 70% relative humidity. Noise data are presented in this Volume 2 for the following aircraft: B-1; B-52B, C, D, E; B-52G, F; B-52H; B-57B, C, E; FB-111A; C-5A; C-9A, C; C-135A, D, F, G, H, K, L, N, Q, R, T; C-135B, C, E, J, M, S, U, V; C-140A, B; C-141A; and SR-71. GRA

N78-28890# Naval Research Lab., Washington, D. C.
SPATIAL IMPULSE RESPONSE OF AN ACOUSTIC LINE RADIATOR: A STUDY OF BOUNDARY-DIFFRACTION-WAVE PHENOMENA AND THEIR EXPERIMENTAL DETECTION Interim Report
Anthony J. Rudgers 22 Feb. 1978 240 p refs
(RR0110842)
(AD-A053395; AD-E000134) Avail: NTIS HC A11/MF A01 CSCL 20/1

The field radiated by a finite-length line source was investigated theoretically and experimentally. A new closed-form, time-domain theoretical expression of this field was derived. This result, which supports the ideas advanced in the Rubinowicz-Maggi diffraction theory, shows the field of a line source to be comprised of three components: a spatially discontinuous cylindrical wave (geometrical wave) and two directional boundary diffraction waves radiated by the ends of the line. The theory is tested by measuring the spatial impulse response of a line transducer. The experiments were conducted in a water tank, using bursts of pseudorandom noise to excite the transducer electrically. By crosscorrelating these electric signals with the acoustic signals that the transducer radiates, the waveform of the source's spatial impulse response is obtained at a number of observation points. Experimental waveforms are compared to the waveforms theoretically expected. Agreement between theory and experiment is excellent. The experiments constitute the first definitive test of the Rubinowicz-Maggi theory in acoustics. Existence of the geometrical and boundary diffraction waves was confirmed. Moreover, since a standard underwater transducer was used as a source in the experiments, this research demonstrates that the Rubinowicz-Maggi theory is applicable in practical situations. Author (GRA)

N78-28891# Texas Univ. at Austin. Defense Research Lab.
ACOUSTIC REFLECTION AND TRANSMISSION PROPERTIES OF SEVERAL TRANSDUCER WINDOW MATERIALS
G. R. Barnard, J. L. Bardin, and J. W. Whiteley 1978 17 p refs
(AD-A053481) Avail: NTIS HC A02/MF A01 CSCL 17/1

The transmission, reflection, and absorption characteristics of a material largely determine its usefulness in underwater sound applications. Uses may include transducer windows, sonar domes, sound reflectors, and linings for test tanks. Most of the experimental data available in the literature are for normal incidence of a plane wave on the material. However, in some applications it is desirable to know the acoustic properties of a material for angles of incidence other than normal. For these reasons a test system was devised to experimentally determine the acoustic properties of materials over a wide range of incident angles. Theoretically, the most straightforward approach to the case of arbitrary incidence is found in Brekhovskikh. The expressions for transmission and reflection coefficients will be used to compare theory and experiment. Hence it is the purpose of this paper to experimentally determine these coefficients for Absonic-A, Plexiglas, Soab, Polyethylene, and Fiberglass for frequencies ranging from 100-500 kc, compare the results with theory, and then examine their usefulness in underwater sound applications based upon these results. Author (GRA)

N78-28892# Naval Ocean Systems Center, San Diego, Calif.
ADAPTIVE ENHANCEMENT OF MULTIPLE SINUSOIDS IN UNCORRELATED NOISE Final Report
J. R. Zeidler, E. H. Satorius, D. M. Chabries, and H. T. Wexler 1 Oct. 1977 36 p refs
(AD-A053461; NOSC/TR-193) Avail: NTIS HC A03/MF A01 CSCL 09/4

The steady-state behavior of the adaptive line enhancer (ALE), a new implementation of adaptive filtering that has application in detecting and tracking narrowband signals in broadband noise, is analysed for a stationary input consisting of multiple sinusoids in white noise. It is shown that the steady-state performance of an L-weight ALE for this case can be modeled by the L X L Wiener-Hopf matrix equation and that this matrix equation can be transformed into a set of 2N coupled linear equations, where N is the number of sinusoids. It is also shown that the expected values of the ALE weights in steady state can be written as a sum of sinusoids and that the amplitude of each sinusoid is coupled to that of all other sinusoids by coefficients that approach zero as the number of ALE weights becomes large. The analytical results are compared to experimental results obtained with a hardware implementation of the ALE of variable length, up to 256 weights, and show good agreement. Theoretical expressions for linear predictive spectral estimates are also derived for multiple sinusoids in white noise. Comparisons are made between the magnitude of the discrete Fourier transform of the ALE weights and the linear predictive spectral estimate for two sinusoids in white noise. Author (GRA)

N78-28893# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 83: KC-135A AIRCRAFT, NEAR AND FAR-FIELD NOISE
Robert G. Powell Dec. 1977 156 p
(AF Proj. 7231)
(AD-A054138; AMRL-TR-75-50-Vol-83) Avail: NTIS HC A08/MF A01 CSCL 01/2

The USAF KC-135A is a long range high performance tanker aircraft powered by four J57-P-43W or 59W turbojet engines. This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating on a concrete runup pad for six engine/power configurations. Near-field data are reported for eleven locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. Refer to Volume 1 of this handbook, 'USAF Bioenvironmental Noise Data Handbook, Vol. 1 'Organization, Content and Application', AMRL-TR-75-50(1) 1975, for discussion of the objective and design. GRA

N78-28894# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SOUND OF LOW-SPEED FANS
B. E. Murray and E. W. Wood 1977 15 p refs Presented at the Meeting of the Cooling Tower Inst., Houston, Tex., 31 Jan. 1977
(CONF-770151-7) Avail: NTIS HC A02/MF A01

A general view of reported studies and prediction techniques for cooling tower noise is given. Fan noise generation is discussed with respect to the control of low- to mid-frequency noise from

mechanical draft cooling towers. An exploratory aerodynamic analysis of fan noise generation is provided leading to empirical relationships for trailing-edge turbulent boundary layer noise, a major noise source in propeller fans. Aeroacoustic means for reducing the sound power output of a fan are discussed. ERA

N78-28895# Exxon Research and Engineering Co., Florham Park, N. J.
INDUCED DRAFT COOLING TOWER NOISE AND ITS CONTROL
J. S. Wang 1977 22 p refs Presented at Meeting of the Cooling Tower Inst., Houston, Tex., 31 Jan. 1977
(CONF-770151-6) Avail: NTIS HC A02/MF A01

Noise data measured at process plants were correlated into a prediction technique for estimating induced draft cooling tower noise in communities adjacent to a plant. Predictions are given in A weighted decibels corresponding to the manner in which regulations are commonly expressed, and in the octave band basis required for design purposes when a noise control measure is found to be necessary. Good agreement is observed between estimated and measured noise levels. The fans and falling water are the major noise sources of induced draft cooling towers. This study shows that the fan noise dominates the water noise at locations distant from the cooling tower and that the noise radiated from the louvered faces dominates that from the fan stacks. If the estimated noise levels should exceed noise criteria, general techniques are given for controlling cooling tower noise to achieve compliance. ERA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N78-28896 Michigan State Univ., East Lansing.
STUDIES OF NUCLEAR MAGNETIC RELAXATION AND MOLECULAR MOTIONS OF SOME SMALL MOLECULES IN DENSE PHASES Ph.D. Thesis
Shaw-Guang Huang 1977 296 p
Avail: Univ. Microfilms Order No. 78-10070

Topics discussed include: (1) complete N-14 and F-19 relaxation of CF3CN and the motional anisotropy of the molecules in the liquid state; (2) C-13 relaxation of CDBr3, and CH2Br3; (3) scalar coupling constants between C-13 and Br-79; (4) anisotropic motions of planar CF2CCl2 molecules in the liquid state; (5) the separation of various F-19 relaxation mechanisms in CF3I, and (6) F-19 NMR lineshapes and the relaxation rates of the F-19 molecule in a number of plastic crystals.
Dissert. Abstr.

N78-28897 Wisconsin Univ. - Madison.
NATURAL ORBITAL ANALYSIS OF MOLECULAR PROPERTIES Ph.D. Thesis
Robert Raymond Merkel 1978 290 p
Avail: Univ. Microfilms Order No. 7806439

A series of calculations was performed on the two lowest (1 sigma +) states of lithium hydride. In addition, the united atom (Be) and separated atom (Li,H) limits of this diatomic molecule were studied. The initial perspective of each system and its associated property values is provided by a self-consistent-field calculation. Thereafter, correlation is incorporated into each wavefunction through the use of several configuration interaction calculations. The natural orbitals of the correlated wavefunctions are subsequently derived and employed in the analysis of various first and second order one-electron property values, in particular, the dipole moment and polarizability. The natural orbitals also provide the basis for additional configuration interaction calculations. Dissert. Abstr.

N78-28898 State Univ. of New York at Buffalo.
QUANTUM STATISTICAL PROPERTIES OF AN OSCILLATOR INTERACTING WITH THE RADIATION FIELD Ph.D. Thesis
Salvador Victor Godoy 1977 93 p
Avail: Univ. Microfilms Order No. 78-10622

The motion of a quantum oscillator interacting with a quantized radiation field is studied. The exact solution shows that the motion of the oscillator is described by a Langevintype equation in which the friction and the effective frequency depend on time. The physical conditions under which these properties become constant were studied. The stochastic force became a Gaussian process and in the limit of long times and weak coupling, had an autocorrelation function with the usual data behavior. For long times, the relaxation time of the correlation between any field mode and the oscillator was studied as a function of the frequency of the electromagnetic mode. A resonance for frequencies near the oscillator frequency is found. Dissert. Abstr.

N78-28899 City Univ. of New York.
REORIENTATIONAL RELAXATION KINETICS OF POLYATOMIC MOLECULES IN DIFFERENT STATES OF CONDENSED MEDIA: INVESTIGATED BY PICOSECOND LASER PULSE INDUCED KERR EFFECT Ph.D. Thesis
Ping-Pei Ho 1978 375 p
Avail: Univ. Microfilms Order No. 7808684

Direct time measurement molecular reorientational relaxation kinetics associated with the optical Kerr effect induced by picosecond laser pulses in the condensed state of matter. Such states encompass neat liquids, mixed binary liquids, supercooled liquids, and plastic crystals. The reorientational relaxation time in neat liquids at moderate viscosity and above the melting temperature was found to be linearly proportional to the measured viscosity. In the supercooled liquid state of salol, the reorientational relaxation time deviated from the variation of the viscosity. This was accounted for by the progressive restriction of molecular rotational motion. The molecular reorientational mechanism in condensed materials is understood in terms of the combination of the following two processes: the transition of molecule from one equilibrium position by overcoming the activation energy of its environment through collisions and diffusional motion; also, there must be empty site available into which the molecule can jump. Dissert. Abstr.

N78-28900# Wisconsin Univ. - Madison. Theoretical Chemistry Inst.
SEMICLASSICAL THEORY OF ROTATIONAL AND VIBRATIONAL EXCITATION IN COLLISIONS OF ATOMS WITH DIATOMIC MOLECULES Interim Report
R. D. Olmstead and C. F. Curtiss Jul. 1977 24 p refs
(Grant AF-AFOSR-2850-75)
(AD-A053573; WIS-TCI-574; AFOSR-78-0764TR) Avail: NTIS HC A02/MF A01 CSCL 20/8

A theory of rotationally and vibrationally inelastic collisions in atom-diatomic molecule scattering is presented in which both rotations and vibrations are treated semiclassically. The formalism, however, allows for an unambiguous specification of the initial and final quantum states even though the S-matrix itself is calculated in the classical limit. This development is particularly suited to the description of inelastic collision processes among the highly excited rotational-vibrational states which lie near the continuum. Author (GRA)

N78-28901# Naval Research Lab., Washington, D. C.
A DIELECTRICALLY LOADED CONVERGING GUIDE ACCELERATOR Interim Report
Phillip Sprangle and A. T. Drobot (Science Applications, Inc., McLean, Va.) Dec. 1977 19 p refs
(RR0110941)
(AD-A053384; AD-E000135; NRL-MR-3660) Avail: NTIS HC A02/MF A01 CSCL 20/7

A scheme for collectively accelerating ions trapped in a space charge wave supported by an intense relativistic electron beam is disussed. In this scheme ions are trapped in the potential well of a low phase velocity space charge wave and accelerated by gradually increasing the phase velocity of the wave. One way of accelerating the wave is by propagating the electron beam through a converging waveguide. The converging structure has the effect of increasing the electron beam energy and thus, accelerating the wave. This paper is concerned mainly with achieving low phase velocity space charge waves in a loaded waveguide. At the limiting electron beam current the minimum phase velocity of a space charge wave approaches zero. By lining the converging guide accelerator with an appropriate

frequency dependent dielectric material, the initial phase velocity can be made small enough to trap low energy protons (approx. 5 MeV) at currents below the limiting current. The electric field associated with the accelerating wave can be as high as a MeV/cm. GRA

N78-28902# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.

PRISM PLOT ANALYSIS OF THE REACTION PI(-)p YIELDS p PI(+)PI(-)PI(-) AT 15 GeV/c

Thomas Lainis May 1977 113 p refs

(AD-A053520) Avail: NTIS HC A06/MF A01 CSCL 20/8

The four body final state pi(-)p yields p pi(-)pi(-)pi(-) has been analyzed at incident beam momentum of 15 GeV/c. The data are taken from 460,000 photographs of the SLAC 82-inch Hydrogen Bubble Chamber. All events were measured by the M.I.T. PEPR (Precision Encoding and Pattern Recognition) system, and processed through the CERBERUS-GEOMAT-SQUAW chain. The four body final state pi(-)p yields p pi(+)pi(-)pi(-) is analyzed by means of the Prism Plot technique. Cross sections, invariant mass spectra and angular distributions for all channels contributing to the final state are presented. The dominant channels are found to be the diffraction dissociation of the beam and nucleon. A new, broad, three pion enhancement, first reported by other groups, is clearly seen in the data with a cross section of 132 + or - 56 microbars. Its mass distribution centers about 1.7 sq GeV/c, and it decays through the rho 0 pi(-) mode. Author (GRA)

N78-28903# Emory Univ., Atlanta, Ga.

TRANSIENTS IN RAPID REACTIONS BY COMBINED MOLECULAR BEAM-MASS SPECTROMETRIC ANALYSIS Final Report

Myron Kaufman Apr. 1978 8 p refs

(Contracts N00014-67-A-0151; N00014-75-C-0200)

(AD-A053549; Rept-14) Avail: NTIS HC A02/MF A01 CSCL 07/4

A novel technique for detecting and monitoring the concentration of transient intermediates in rapid gas-phase reactions has been developed and employed in studies of gaseous halogen chemistry and electric discharge chemistry. The technique, termed molecular beam analysis, combines mass spectrometry of ions with molecular beam characterization of neutrals prior to ionization, in order to achieve unambiguous identification of intermediates in gaseous reactions. In favorable cases, a sensitivity of 10 to the 11th power/cu cm has been attained. Using a steady-state flow-tube reactor, molecular beam analysis has been employed for kinetics studies of the reactions of F with CCl4, CF3I, CCl3Br and CF3Br; of Cl with HCl and of Br with F2. Additionally, chemiluminescence generated in reactions of atomic fluorine was surveyed, and that in the combination reaction of H with F studied in detail. A gas phase titration for fluorine atoms was developed and used in a measurement of the rate constant for homogeneous recombination of fluorine atoms. Weak rf discharges were evaluated as sources of reactive intermediates for kinetic studies. Author (GRA)

N78-28904# Kansas State Univ., Manhattan. Dept. of Physics.

DEEXCITATION OF IONIZED ATOMS Final Report, 1 Jul. 1971 - 31 Mar. 1978

Chander P. Bhalla 1 May 1978 5 p refs

(Grants DAAG29-77-G-0029; DAAG29-76-G-0096; DAHC04-74-G-0137; DA-ARO(D)-31-124-71-G185)

(AD-A054664; ARO-9827.35-P) Avail: NTIS HC A02/MF A01 CSCL 07/4

The titles of publications, technical reports, and students who earned degrees under the Grant are listed for the final report. Author (GRA)

N78-28905# Stanford Linear Accelerator Center, Calif.

CALCULATION OF POSITRON SOURCE YIELDS

M. B. James, R. H. Miller, and B. M. Woo Jul. 1977 8 p refs Presented at the 10th Intern. Conf. on High Energy Accelerators, Serpukhov, USSR, 11-17 Jul. 1977

(Contract EY-76-S-03-0326)

(SLAC-PUB-1969; Conf-770709-18) Avail: NTIS HC A02/MF A01

A Monte Carlo program was used to calculate the distribution in phase space of the electromagnetic shower from the target of the positron source. Positron and electron yields were calculated for copper and tungsten targets. A ray tracing program was used to calculate the acceptance of the focusing system. The existing source makes use of an adiabatically tapered solenoid. The yield of this system was compared with three alternatives: two possible modifications of the tapered solenoid, and a focusing system using a short solenoid as a quarter wave transformer. The calculated yield for the existing system is in reasonable agreement with experimental observation. ERA

N78-28906# Brookhaven National Lab., Upton, N. Y.

MEASUREMENT OF ENERGY LOSS IN THE REGION OF RELATIVISTIC RISE FOR PARTICLE IDENTIFICATION

J. Fischer, H. Okuno, and A. H. Walenta 1977 11 p Presented at the Isabelle Workshop, Upton, N. Y., 18 Jul. 1977

(Contract EY-76-C-02-0016)

(BNL-23561; Conf-770753-14) Avail: NTIS HC A02/MF A01

A multilayer drift chamber of the socalled bicycle type with a radius of 1.5 m is considered. The useful track length will be 1/sub min/ = 1.3 m for a straight track at 90 deg to the beam axis. Two examples for possible subdivisions of this volume are chosen: number of layers, n = 200 and thickness/layer, x = 6.5 mm; and n = 56 and x = 23 mm. An analysis is given in which the counting gas, the pressure, and the maximum allowable particle rate are considered as variables. ERA

N78-28907# Brookhaven National Lab., Upton, N. Y.

COMMENTS ON MUON TRAPPING

A. J. Stevens and A. M. Thorndike 16 Jun. 1977 22 p refs

(Contract EY-76-C-02-0016)

(BNL-50740) Avail: NTIS HC A02/MF A01

Muons that result from the collisions of protons in the ISABELLE beams with other nucleons introduce important background or signal for experiments. Their ability to pass through the conductors and steel of ISABELLE magnets results in complicated trajectories. Some oscillate about quasistable orbits and are called trapped. A number of typical trajectories were plotted, and flux estimates were made with a Monte Carlo program, HALO. Trapping tends to reduce shielding requirements somewhat, but the effect does not appear to be a very large one from these initial investigations. ERA

N78-28908# Los Alamos Scientific Lab., N. Mex.

GAMMA-RAY MEASUREMENTS WITH THE SEGMENTED GAMMA SCAN

E. R. Martin, D. F. Jones, and J. L. Parker Dec. 1977 157 p refs

(Contract W-7405-eng-36)

(LA-7059-M) Avail: NTIS HC A08/MF A01

A revised and updated operation and maintenance manual for the segmented gamma-scan instrument is presented, which describes routine assay techniques as well as the theory of operation in sufficient depth that an experienced assayist can make nonroutine assays on a wide variety of materials and samples. In addition, complete electronic and electrical schematics of the Los Alamos Scientific Laboratory designed portions of the system are presented, along with sufficient system and circuit description to facilitate maintenance and troubleshooting. Complete software system descriptions are included. ERA

N78-28909# Los Alamos Scientific Lab., N. Mex.

INSTRUMENT FOR OBSERVING TRANSIENT COSMIC GAMMA-RAY SOURCES FOR THE ISEE-C HELIOCENTRIC SPACECRAFT

W. D. Evans, W. P. Aiello, and R. W. Klebesadel Dec. 1977 53 p refs

(Contract W-7405-eng-36)

(LA-7051-MS) Avail: NTIS HC A04/MF A01

Satellite instrumentation that would serve as one element of a three satellite network to provide precise directional information for the recently discovered cosmic gamma ray bursts is described. The proposed network would be capable of determining source locations with uncertainties of less than one arc minute, sufficient for a meaningful optical and radio search. The association of the gamma bursts with a known type of

astrophysical object provides the most direct method for establishing source distances and thus defining the overall energetics of the emission process. ERA

N78-28910# California Univ., Livermore. Lawrence Livermore Lab.
EXPLORATORY EXPERIMENTS COMPARING DAMAGE EFFECTS OF HIGH-ENERGY NEUTRONS AND FISSION-REACTOR NEUTRONS IN METALS
J. B. Mitchell 12 Jan. 1978 13 p refs
(Contract W-7405-eng-48)
(UCRL-52388) Avail: NTIS HC A02/MF A01

A description is given of stripping sources and results are presented of some exploratory experiments in which 0.5-mm-thick tensile specimens of copper, vanadium, niobium, and Nb-1 wt% Zr alloy were irradiated by high-energy neutrons from these sources and by lower-energy neutrons from the Livermore Pool-Type Reactor. After being irradiated, the specimens were tensile-tested, and the increases in their 0.2%-offset yield strengths were related to the neutron fluences and energies to which they were subjected. ERA

N78-28911# Wright State Univ., Dayton, Ohio.
DIRECT DETERMINATION OF ATOM AND RADICAL CONCENTRATIONS IN THERMAL REACTIONS OF HYDROCARBONS AND OTHER GASES Progress Report, 1 Jan. - 31 Dec. 1977
G. B. Skinner, A. Lifshitz, D. R. Wood, and C. C. Chiang Jan. 1978 9 p refs
(Contract EY-76-S-02-2944)
(COO-2944-2) Avail: NTIS HC A02/MF A01

A shock tube and an optical system to be used to measure H and D atom concentrations are described. The performance of the microwave discharge lamps was characterized by numerous high-resolution spectroscopic profiles, so that the shapes of the Lyman-alpha lines produced under various operating conditions were obtained. Measurements of H or D atom concentrations in shock-heated mixtures of D2-N2O-Ar, D2-O2-Ar and H2-O2-Ar were made. ERA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N78-28912 Case Western Reserve Univ., Cleveland, Ohio.
A STUDY OF LEPTOPRODUCTION MECHANISMS FOR NEUTRAL WEAK BOSONS Ph.D. Thesis
Leon Bernard Gordon 1978 107 p
Avail: Univ. Microfilms Order No. 78-09281

The details are discussed of the theoretical predictions for the reaction l superscript + or -, + N = Z superscript 0 + l or -, + N prime, in which the neutral weak vector boson is radiated by the lepton. The cases are considered where the target nucleon is either a proton or neutron and the recoil is either elastic or inelastic. For the case of elastically recoiling proton targets the energy and angular spectra for all final state particles, polarization effects and leptonic decay of the Z superscript 0 are discussed. In addition production rates are calculated for a scalar Z superscript 0. Results are given for the reaction V + N = V + N prime + Z superscript 0 where we permit the Z superscript 0 to recoil electromagnetically via anomalous moments. Dissert. Abstr.

N78-28913* National Aeronautics and Space Administration. Pasadena Office, Calif.
CONTROL FOR NUCLEAR THERMIONIC POWER SOURCE Patent
Craig D. Sawyer, inventor (to NASA) (JPL) Issued 18 Apr. 1978 9 p Filed 21 Nov. 1975. Supersedes N76-15573 (14 - 06, p 0738) Continuation-in-part of abandoned US Patent Appl. SN-294738, filed 3 Oct. 1972
(NASA-Case-NPO-13114-2; US-Patent-4,085,004; US-Patent-Appl-SN-634214; US-Patent-Appl-SN-294738; US-Patent-Class-176-22; US-Patent-Class-176-39; US-Patent-Class-176-33) Avail: US Patent Office CSCL 10B

A control for a power source which includes nuclear fuel interspersed with thermionic converters, is described. A power regulator maintains a substantially constant output voltage to a variable load, and a control circuit drives a neutron flux regulator in accordance with the current supplied to the power regulator and the neutron flux density in the region of the converters. The control circuit generates a control signal which is the difference between the neutron flux density and a linear function of the current, and drives the neutron regulator in a direction to decrease or increase the neutron flux according to the polarity of the control signal. Official Gazette of the U.S. Patent Office

N78-28914 Texas Technological Univ., Lubbock.
A THEORETICAL STUDY OF INERTIAL CONFINEMENT: MODEL DEVELOPMENT AND ANALYSES OF LASER INDUCED FUSION BY IMPLOSION OF D-T PELLETS Ph.D. Thesis
Earle Cale Davis 1977 174 p
Avail: Univ. Microfilms Order No. 7810833

A possible source of energy, which results from the fusion process of inertial confinement, utilizes deuterium-tritium pellets and the energy obtained from lasers as the initial driving force to concentrate ablated materials from the D-T pellet. This plasma plume region is rapidly heated by lasers to produce a compressional wave in the overdense region of the target pellet. This wave intensifies until an implosion of the pellet is initiated with the subsequent release of fusion energy. The laser interaction with the plasma requires identification and analysis of the effects due to the competing processes of pressure, viscosity, heat conduction, thermal equilibration, thermonuclear energy generation, laser energy absorption and bremstrahlung radiation. A computer model was developed and a composite theoretical simulation of this fusion process is discussed. Dissert. Abstr.

N78-28915 Texas Technological Univ., Lubbock.
RADIAL-MOMENT ANALYSIS FOR MUONIC X-RAYS Ph.D. Thesis
Asok Kumar Ray 1977 207 p
Avail: Univ. Microfilms Order No. 7810848

The effect of the size and radial shape of a spherical nuclei on muonic-atom energies is studied. Each binding energy and each transition energy in the muonic atom determines a particular generalized radial moment of the nuclear charge distribution, or an equivalent radius. The form of the generalized radial moment, however, varies, the most widely accepted one being the two-parameter Barrett form. A single-parameter form approximating the transition potential in muonic atoms, and thereby, a new form for the generalized radial moment are presented. The single-parameter form yields comparable results with that obtained by the two-parameter Barrett form in radial-moment analysis. The single parameter is isotopically independent and is uniquely defined by the particular transition of a given element. Dissert. Abstr.

N78-28916 Minnesota Univ., Minneapolis.
ON-LINE MASS MEASUREMENTS OF SHORT-LIVED RUBIDIUM AND CESIUM ISOTOPES PRODUCED IN PROTON FISSION OF NATURAL URANIUM Ph.D. Thesis
Ronald James Smith, II 1977 122 p
Avail: Univ. Microfilms Order No. 7809747

Direct on-line mass measurements are reported for short-lived neutron-rich rubidium and cesium isotopes produced in the proton fission of natural uranium. These measurements were made using a specially constructed double focusing mass spectrometer. Using a computer peak matching technique, absolute masses and mass differences were measured with a precision of 150 to 1000 microunits. Mass differences and absolute masses for rubidium isotopes with 89 less than A or equal to 95 and for cesium isotopes with 139 less than A or equal to 143 are reported. Neutron separation energies were calculated. Comparisons were made to corresponding masses calculated from beta-decay Q-value measurements. Dissert. Abstr.

N78-28917 British Library Lending Div., Boston Spa (England).
BEHAVIOR OF ELECTRON BEAMS IN THE PREVACUUM 1

Siegfried Schiller Nov. 1977 23 p refs Transl. into ENGLISH from Schweisstechnik (West Germany), v. 21, n. 1, 1971 p 11-16
(BLL-RTS-11009) Avail: British Library Lending Div., Boston Spa, Engl.: £15.00; 14 overseas, 15 European or 60 UK BLL photocopy coupons

The alteration of electron beam characteristics when working under elevated pressures is caused by the scatter process of the electrons in the residual gas, by the plasma produced, and frequently by the vapor generated. The overall energy loss, energy transmission, and energy density distribution over a work piece is discussed as a function of pressure in electron beam welding, electron beam smelting, and electron beam evaporation. Measurements were made in high and fine vacuum to determine the electrical efficiency, incidental energy, energy intake, electron current, influence of the filament beam formation, and the power density distribution in the impinging electron beam. A.R.H.

N78-28918# Tennessee Univ., Knoxville.
SYSTEM FOR UNATTENDED SURVEILLANCE OF NUCLEAR REACTOR BEHAVIOR
R. C. Gonzalez and L. C. Howington (Union Carbide Corp., Oak Ridge, Tenn.) 1977 7 p refs Presented at IEEE Conf. on Decision and Control, New Orleans, 7 Dec. 1977
(Contract W-7405-eng-26)
(CONF-771205-2) Avail: NTIS HC A02/MF A01

A multivariate statistical pattern recognition system for reactor noise analysis is presented. The basis of the system is a transformation for decoupling correlated variables and algorithms for inferring probability density functions. The system is adaptable to a variety of statistical properties of the data, and it has learning, tracking, updating, and dimensionality reduction capabilities. System design emphasizes control of the false alarm rate. Its abilities to learn normal patterns and to recognize deviations from these patterns were evaluated by experiments at the ORNL high-flux isotope reactor. Power perturbations of thess than 0.1% of the mean value in selected frequency ranges were readily detected by the pattern recognition system. ERA

N78-28919# State Univ. of New York, Stony Brook.
ACCELERATION AND STORAGE OF POLARIZED BEAMS
E. D. Courant 1977 7 p refs Presented at Workshop on Polarized Proton Beams, Ann Arbor, Mich., 18-27 Oct. 1977
(BNL-23674; Conf-7710115-1) Avail: NTIS HC A02/MF A01

The theory of polarized beams in circular accelerators for storage rings are reviewed, and the effects of depolarizing resonances, both steady state and passage through resonance, are discussed. The resonance width was evaluated, and the possibilities of accelerating polarized particles was considered. ERA

N78-28920# Stanford Linear Accelerator Center, Calif.
PRECISION ENERGY MEASUREMENT TECHNIQUE
Z. D. Farkas, H. L. Martin, and R. H. Miller Jul. 1977 6 p ref Presented at the 10th Intern. Conf. on High Energy Accelerators, Serpukhov, USSR, 11-17 Jul. 1977
(Contract EY-76-S-03-0326)
(SLAC-PUB-1970; Conf-770709-19) Avail: NTIS HC A02/MF A01

A technique that was successfully tested made it possible to open the slits to delta p/p = +-0.5% and measure the energy centroid of each beam pulse with a precision of +-0.01%. With +-0.5% slits, nearly 100% of the beam is transmitted from the linear accelerator to the target. The technique depends on the fact that the path length through bending magnets in the beam switchyard depends on energy. An estimate of resolution is given, and long term stability, phase measurement electronics, and experimental tests are discussed. ERA

N78-28921# Massachusetts Inst. of Tech., Cambridge.
REPORT OF GROUP II-2: RUNNING AT ISA
M. Chen, J. C. Herrera (Brookhaven Natl. Lab.), L. Littenberg (Brookhaven Natl. Lab.), A. M. Thorndike (Brookhaven Natl. Lab.), H. Ogren (Indiana Univ., Bloomington), K. Potter (CERN), and E. I. Rosenberg (Chicago Univ.) 4 Aug. 1977 10 p Presented at the ISABELLE Workshop, Upton, N. Y., 18 Jul. 1977
(Contract EY-76-C-02-0016)
(BNL-23537; Conf-770753-24) Avail: NTIS HC A02/MF A01

A discussion is given of the anticipated operating conditions at the ISABELLE storage rings. Communications between experimental and control areas are considered, and beam luminosity monitoring is discussed. Running conditions and expected problems are outlined. ERA

N78-28922# Brookhaven National Lab., Upton, N. Y.
PROPORTIONAL CHAMBERS AND MULTIWIRE DRIFT CHAMBERS AT HIGH RATES
A. H. Walenta 1977 13 p refs Presented at ISABELLE Workshop, Upton, N. Y., 18 Jul. 1977
(Contract EY-76-C-02-0016)
(BNL-23560; Conf-770753-13) Avail: NTIS HC A02/MF A01

Examples are given for a typical low noise amplifier as well as for a typical integrated cheap amplifier. The rate/wire length N depends on the chamber arrangement, wire spacing, etc. In multiwire drift chambers, a single wire shows spacecharge effects reducing the pulse height by 1% at a rate of N = 7 x 1,000 mm superscript -1 sec superscript -1. At a rate of N approximately equal to 100000 mm superscript -1 sec superscript -1 an efficiency loss of the order of 1% was noticed. The aging effect due to deposits on the anode wire can be reduced using low noise amplifiers and low gas gain to such an extent that a lifetime of about half a year at ISABELLE can be expected. The use of conventional cheap preamplifiers resulted in a typical lifetime of about 30 days. Improvements are probable. The time resolution of delta t/sub/r = 4 nesc fwhm seemed adequate for event rates of 10 to the 7th power superscript -1. The memory time delta t/sub m/ greater than or equal to 100 nsec may cause serious problems for pattern recognition depending on layout and readout. The use of induced signals on cathode pads, thus reading out shorter parts of the wire, can solve the problem. ERA

N78-28923# Maryland Univ., College Park.
REVIEW OF EXPERIMENTS
C. Chang, G. Yodh, D. Cutts (Brown Univ., Providence), R. Lanou (Brown Univ., Providence), E. Engels (Pittsburg Univ., Pa.), M. Kramer (City College of the City Univ. of New York), and G. Danby (Brookhaven National Lab., Upton, N.Y.) 18 Aug. 1977 26 p refs Presented at the ISABELLE Workshop, Upton, N. Y., 18 Jul. 1977
(Contract EY-76-C-02-0016)
(BNL-23591; Conf-770753-23) Avail: NTIS HC A03/MF A01

A study was made to examine the effects of raising the ISA from 200 x 200 GeV to 400 x 400 GeV would have on the canonical experiments. These were canonical in the sense that they span the full range of foreseeable physics and have served as topics in previous Summer Studies and Workshops which resulted in quite explicit hardware designs and experimental goals. The study results indicated that all of the canonical experiments survived. Some were actually improved, some were unaffected, and some required changes which are suggested. In general, the 90 deg experiments were relatively unaffected. The single arm small angle spectrometer, the wide aperture spectrometer and the Coulomb interference experiment have the largest number of modifications suggested. ERA

N78-28924# Brookhaven National Lab., Upton, N. Y.
SCHEMES FOR ANTI pP INTERACTIONS AT ISABELLE
R. B. Palmer 8 Sep. 1977 22 p refs Presented at the ISABELLE Workshop, Upton, N. Y., 18 Jul. 1977
(Contract EY-76-C-02-0016)
(BNL-23562; Conf-770753-15) Avail: NTIS HC A02/MF A01

Various schemes for obtaining anti pp interactions are outlined, and the luminosities obtainable for each case calculated. In the simplest realistic case, a luminosity of 1.3 x 10 to the 29th power is obtained with a 13 hour filling time. The addition of special rf systems in both the AGS and ISABELLE give a scheme with luminosity 8 x 10 to the 29th power in 6 hours. The use of stochastic cooling to stack raises the luminosity to as high as 10 to the 31st power but the filling time is then 68 hours.

Finally a scheme is considered that uses a special 30 GeV capture ring. With this, a luminosity of 10 to the 31st power could be achieved after 20 hours, or higher if a larger filling time were acceptable. Further gains could be made if a smaller proton spot on the target is used but a simple calculation suggests that even the spot size assumed may explode the target too fast. ERA

N78-28925# Los Alamos Scientific Lab., N. Mex.
SOME NEW ACCELERATING STRUCTURES FOR HIGH CURRENT INTENSITY ACCELERATORS
J. J. Manca Mar. 1978 10 p refs
(Contract W-7405-eng-36)
(LA-7157-MS) Avail: NTIS HC A02/MF A01

The space charge effect inside the beam of charged particles causes serious problems in high-intensity linear particle accelerators. At the present time there is only the Alvarez-Blewett accelerating structure which uses continuous strong focusing to keep the beam confined to the axis. The most serious problem is at the injection end of the accelerator where the particle velocities are low and the drift tube structure has decreased efficiency. It is suggested that some new or less well known accelerating structures using RF quadrupole focusing and H-type mode resonators may solve this problem. The disk-and-washer structure with very high coupling coefficient can be used successfully for the high-energy part of the accelerator. A newly developed coaxial coupler solves the problem of the intertank RF coupling. ERA

N78-28926# California Univ., Berkeley. Lawrence Berkeley Lab.
SOME ILLUSTRATIONS OF STOCHASTICITY
L. J. Laslett 1977 30 p refs Presented at Workshop on Non-Linear Dyn., LaJolla, Calif., 27 Dec. 1977
(Contract W-7405-eng-48)
(LBL-7247; Conf-771234-1) Avail: NTIS HC A03/MF A01

A complex, and apparently stochastic, character frequently can be seen to occur in the solutions to simple Hamiltonian problems. Such behavior is of interest, and potentially of importance, to designers of particle accelerators as well as to workers in other fields of physics and related disciplines. Even a slow development of disorder in the motion of particles in a circular accelerator or storage ring could be troublesome, because a practical design requires the beam particles to remain confined in an orderly manner within a narrow beam tube for literally tens of billions of revolutions. The material presented is primarily the result of computer calculations made to investigate the occurrence of stochasticity. ERA

N78-28927# California Univ., Berkeley. Lawrence Berkeley Lab.
QUASI-STATIC DRIFT-TUBE ACCELERATING STRUCTURES FOR LOW-SPEED HEAVY IONS
A. Faltens and D. Keefe 3 Nov. 1977 28 p refs Presented at the Heavy Ion Fusion Workshop, Upton, N. Y., 17 Oct. 1977
(Contract W-7405-eng-48)
(LBL-7200; Conf-771073-6) Avail: NTIS HC A03/MF A01

The major attractions of the pulsed drift-tubes are that they are non-resonant structures and that they appear suitable for accelerating a very high current bunch at low energies. The mechanical tolerances of the non-resonant structure are very loose and the cost per meter should be low; the cost of the transport system is expected to be the major cost. The pulse power modulators used to drive the drift-tubes are inexpensive compared to R.F. sources with equivalent peak-power. The longitudinal emittance of the beam emerging from the structure could be extremely low. ERA

N78-28928# Los Alamos Scientific Lab., N. Mex.
COLLECTIVE ION ACCELERATION
B. B. Godfrey, R. J. Faehl, B. S. Newberger, W. R. Shanahan, and L. E. Thode 1977 286 p refs
(Contract W-7405-eng-36)
(LA-7148-PR) Avail: NTIS HC A13/MF A01

Progress achieved in the understanding and development of collective ion acceleration is presented. Extensive analytic and computational studies of slow cyclotron wave growth on an electron beam in a helix amplifier were performed. Research included precise determination of linear coupling between beam and helix, suppression of undesired transients and end effects, and two-dimensional simulations of wave growth in physically realizable systems. Electrostatic well depths produced exceed requirements for the Autoresonant Ion Acceleration feasibility experiment. Acceleration of test ions to modest energies in the troughs of such waves was also demonstrated. Smaller efforts were devoted to alternative acceleration mechanisms. Langmuir wave phase velocity in Converging Guide Acceleration was calculated as a function of the ratio of electron beam current to space-charge limiting current. A new collective acceleration approach, in which cyclotron wave phase velocity is varied by modulation of electron beam voltage, is proposed. ERA

N78-28929# Los Alamos Scientific Lab., N. Mex.
EXPERIMENTAL PROGRAM TO VALIDATE ANALYSES OF ACCELERATOR BREEDER CONCEPTS
W. L. Talbert, Jr., G. J. Russell, and R. E. Malenfant 1977 32 p refs Presented at Accelerator Breeder Conf., Los Alamos, New Mexico, 8 Nov. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2552; Conf-771159-1) Avail: NTIS HC A04/MF A01

The concept of using high-energy particle accelerators to produce neutrons for converting fertile material to fissile is over 25 years old. It is only relatively recently that accelerator design has progressed to a point where the operation approaches commercial viability. Critical unknowns in the concept were identified in a detailed study of specic configurations. Experiments to elucidate these unknowns in a timely manner using existing material and facilities are defined and identified. Basic measurements are described to evaluate effects of the primary particle beam and resulting secondary particles in massive assemblies of most materials of interest. ERA

N78-28930# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazioni.
EXPERIMENTAL TEST OF THE MECHANISM OF REACTION FOR (e,e'p) COINCIDENCE EXPERIMENT
M. Bernheim (Centre d'Etudes Nucl. de Saclay, France), A. Bussiere (Centre d'Etudes Nucl. de Saclay, France), S. Frullani, J. Mougey (Centre d'Etudes Nucl. de Saclay, France), M. Priou (Centre d'Etudes Nucl. de Saclay, France), D. Royer (Centre d'Etudes Nucl. de Saclay, France), I. Sick (Basel Univ.), D. Tarnowski (Centre d'Etudes Nucl. de Saclay, France), and S. Turk (Centre d'Etudes Nucl. de Saclay, France) 27 Jun. 1977 24 p refs Submitted for publication
(ISS-P-77/6) Avail: NTIS HC A02/MF A01

In order to test the validity of the distorted wave impulse approximation to describe (e,e'p) reactions and/or the suitability of the available optical potential parameters to calculate the distortion, the spectral function was measured for 12 C (e,e'p) 11 B in different kinematical configurations. Experimental results are shown together with the distributions computed with several values of the optical potential parameters. Data seem to indicate the necessity of using different parameters for p hole states and s hole states. Author (ESA)

N78-28931# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazioni.
A GENERAL PURPOSE NOVA-CAMAC DATA HANDLING SYSTEM FOR HIGH ENERGY PHYSICS EXPERIMENTS
R. Biancastelli 2 May 1977 19 p
(ISS-T-77/3) Avail: NTIS HC A02/MF A01

A basic software package for NOVA computers specifically designed for high energy physics experiments with on-line data processing is described. Author (ESA)

74 OPTICS

Includes light phenomena.

N78-28932 Mississippi State Univ., State College.
SOLID-STATE IMAGING DEVICE PARAMETER STUDY FOR USE IN ELECTRO-OPTIC TRACKING SYSTEMS
Ph.D. Thesis

Wilson Earl Taylor, Jr. 1977 137 p
Avail: Univ. Microfilms Order No. 78-07580

Five existing trackers which utilize solid-state imagers as sensors are evaluated. Charge-coupled devices (CCDs), charge injection devices (CIDs), and photodiode arrays are investigated as the contrast, irradiance, and target velocity are varied on the image plane. Dissert. Abstr.

N78-28933 Utah Univ., Salt Lake City.
THEORY OF IMAGE TRANSFER THROUGH A FABRY-PEROT INTERFEROMETER AND CONVERSION TO VISIBLE OF INFRARED IMAGES Ph.D. Thesis
Abbas Riazi 1978 206 p
Avail: Univ. Microfilms Order No. 78-07207

Image transformation through a Fabry-Perot interferometer and the conversion of infrared to visible images are studied. A Fourier expansion of the fields in conjunction with the FFT algorithm was used in determining the level of image distortion due to passage through an FPI. The phenomenon of image deterioration was also examined by a mode decomposition technique. Various theoretical expressions are derived and curves relating the characteristics of the FPI to the spatial content of the image are generated. It is seen that initially as Fresnel number (N) increases, the resolving number of transits (M) increases rapidly; however, for values of N greater than 1000, the increase in M is very slow. This is shown to be due to the asymptotic behavior of the additional phase shift per transit of each transverse model. Dissert. Abstr.

N78-28934*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE LIXISCOPE: A POCKET-SIZE X-RAY IMAGING SYSTEM
Lo I. Yin and Stephen M. Seltzer (NBS, Washington, D. C.) 10 Jan. 1978 15 p refs Submitted for publication
(NASA-TM-78064) Avail: NTIS HC A02/MF A01 CSCL 20F

A Low Intensity X ray Imaging device with the acronym LIXISCOPE is described. The Lixiscope has a small format and is powered only by a 2.7V battery. The high inherent gain of the Lixiscope permits the use of radioactive sources in lieu of X-ray machines in some fluoroscopic applications. In this mode of operation the complete X ray imaging system is truly portable and pocket-sized. Author

N78-28935*# Stanford Univ., Calif. Inst. for Plasma Research.
RESEARCH OF ELASTICALLY BENT GLASS STRIPS TO PRODUCE HIGH RESOLUTION X-RAY AND EUV OPTICS Final Technical Report, 15 Oct. 1976 - 14 Oct. 1977
A. B. C. Walker, Jr. and James H. Underwood Aug. 1978 118 p refs
(Grant NsG-5132)
(NASA-CR-157350) Avail: NTIS HC A06/MF A01 CSCL 20F

The feasibility of using elastically bent strips of glass or other material as glancing incidence X-ray mirrors was investigated. The design and testing of such strip mirrors to determine their resolution at X-ray wavelengths is described. The narrowest focus in X-rays obtainable with a glass strip of constant width, bent to approximate an elliptic contour by moments at each end, was 0.05 cm FWHM. When a strip whose width was tapered to more closely approximate an elliptical contour was substituted for the constant width strip mirror, resolution was approximately doubled to a focal image width of 0.025 FWHM. Factors that influence the suitability of the concept to specific applications treated include fitting of mirror deflection curves to conics, anticlastic curvature, creep, and the limitations of simple bending theory. The use of a bent strip mirror in the testing of a microchannel plate X-ray detector is also described. A.R.H.

N78-28936# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
OPERATIONAL AND COST CONSIDERATIONS IN THE USE OF OPTICAL WAVEGUIDES IN A LOCAL INFORMATION TRANSFER SYSTEM Final Report
R. L. Gallawa and W. J. Hartman Nov. 1977 81 p refs Prepared for Army
(AD-A053600; OT-77-133) Avail: NTIS HC A05/MF A01 CSCL 17/2

Attention is given to the potential use of optical waveguides in an information exchange system consisting of many terminals distributed uniformly over a circle of radius R. Cost comparison is given between coaxial cable and glass fiber systems, based on a model described in Section 2. The results show that the wide bandwidth capability of fibers leads to definite cost advantages as data rates increase. The model concentrates on the star and the loop distribution systems. The report also discusses various ways of coupling energy into and out of the fibers. GRA

N78-28937# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
THE CROSSED-BEAM CORRELATION METHOD
G. T. Kalghatgi Nov. 1977 33 p refs
(AASU-339) Avail: NTIS HC A03/MF A01

Two mutually perpendicular light beams are passed through a turbulent flow region normal to the flow direction. Using positron sensitive detectors it is possible to simultaneously measure the intensity and deflection in two directions perpendicular to the beam direction of each beam. To obtain localized information the two beams are made to intersect. The covariance of the signals at the two detectors then yields information located at the point of intersection of the two beams. Applications of the crossed beam correlation technique are discussed. ESA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N78-28938 British Library Lending Div., Boston Spa (England).
THE STABILITY OF THE HIGH INTENSITY GLOW DISCHARGE
W. Weizel and B. Brandt 2 Nov. 1977 15 p Transl. into ENGLISH from Forschungsber. Wirt. Verkehrsmin. Nordrhein-Westfallen (West Germany), 267, 1956 15 p
(BLLD-HTRG-75-(4335.4)) Avail: British Library Lending Div., Boston Spa, Engl.

A gas pressure of the order of a few mm Hg and an electrode gap of a few centimeters enabled a glow discharge to be produced without difficulty at currents below an ampere, whereas the discharge tended to become an arc discharge, if the current was increased to several amperes. Regions of absolute and relative stability of glow discharges are discussed, along with cathode sparking and spark-type discharges. J.A.M.

N78-28939 British Library Lending Div., Boston Spa (England).
LOW-FREQUENCY OSCILLATIONS IN THE POSITIVE COLUMN OF GLOW DISCHARGES IN GASES
Vaclav Krejci Mar. 1978 15 p refs Transl. into ENGLISH from Cesk. Cas. Fis. (Czech.), v. 8, no. 1, 1958 p 46-56
(BLL-RTS-11117) Avail: British Library Lending Div., Boston Spa, Engl.: 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

A simplified version of Granovskii's theory of the dynamic processes in discharges was linearized to obtain approximate formulae for the frequency and damping of the oscillations which simultaneously take place throughout the positive column of a glow discharge. These formulae are then compared with the measured relationship between the frequency of the oscillations obtained and the various parameters of the discharge. The results show the theory to have been correct. Author

N78-28940 Georgia Inst. of Tech., Atlanta.
MAGNETOHYDRODYNAMIC EFFECTS ON HEAT TRANSFER IN TOKAMAK FUSION REACTOR BLANKETS Ph.D. Thesis
Shahid Khan 1978 259 p
Avail: Univ. Microfilms Order No. 78-09025

Magnetohydrodynamic flow in the entrance region of a square channel is considered. This flow situation is shown to be of a type found in Tokamak fusion reactor blankets with circulating lithium coolant. The results show that the MHD pressure drop is strongly dependent on the electrical conductivity of the duct

walls perpendicular to the imposed transverse magnetic field and relatively insensitive to the conductivity of the parallel walls. Velocity and temperature profiles are flattened and heat transfer coefficients increased with the largest increase occurring when the duct corners are electrically insulated. Hydrodynamic entry lengths are shown to decrease significantly with Hartmann number increase, and minutely with wall electrical conductivity increase. The main conclusions are that, by judicious use of current breaks, insulated corners and walls, the MHD pumping losses should be reduceable to a tolerable level, and at the same time benefits of blanket simplification and heat transfer enhancement can be enjoyed. Dissert. Abstr.

N78-28941# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
HIGH FREQUENCY STABILITY OF FIELD-REVERSED ION RINGS IN A BACKGROUND PLASMA
Gerson Otto Ludwig and Ravindra N. Sudan May 1978 56 p refs Sponsored in part by Fundo Nacl. de Desenvolvimento Cient. e Technol.
(INPE-1257-PE-134) Avail: NTIS HC A03/MF A01

It is found that a background plasma subjected to the nonuniform magnetic field configuration produced by an ion ring supports short wavelength, electrostatic, flute-type normal modes at frequencies above the ion plasma frequency. These modes can be destabilized by the interaction with the energetic ions of the ring. Author

N78-28942# Naval Research Lab., Washington, D. C.
DEPOLARIZATION IN LASER PROBING OF INHOMOGENEOUS MAGNETIZED PLASMAS Interim Report
R. H. Lehmberg and J. A. Stamper Feb. 1978 15 p refs Sponsored in part by DoE
(AD-A053385; AD-E000143; NRL-MR-3703) Avail: NTIS HC A02/MF A01 CSCL 20/9

Density gradients and magnetic fields transverse to the propagation direction can produce polarization dependent phase shifts in a laser probing beam used for Faraday rotation studies of longitudinal magnetic fields in plasmas. The resulting depolarization should be considered when probing with fast optics near the critical density. Author (GRA)

N78-28943# Princeton Univ., N. J. Plasma Physics Lab.
DETECTION OF LOWER HYBRID WAVES WITHIN A PLASMA BY MICROWAVE SCATTERING
R. W. Motley, F. J. Paoloni, S. Bernabei, and W. M. Hooke Mar. 1978 20 p refs
(Contract EY-76-C-02-3073)
(PPPL-1414) Avail: NTIS HC A02/MF A01

The spatial distribution and intensity of electrostatic waves injected into a hot plasma may be inferred from the scattering of millimeter microwaves. We report measurements on the 30 deg scattering of 8.6 mm microwaves by a 500 W, 2.45 GHz slow wave excited in a linear plasma by a phased array of two waveguides. From the magnitude of the scattered signal and auxiliary measurements with probes, we infer that a large fraction of the injected power penetrates to the center of the overdense test plasma. ERA

N78-28944# Sandia Labs., Albuquerque, N. Mex.
NUMERICAL CODES FOR MHD FLOWS Quarterly Technical Progress Report, Jul. - Sep. 1977
K. J. Touryan, F. G. Blottner, A. J. Russo, and J. G. Taylor Jan. 1978 31 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0079) Avail: NTIS HC A03/MF A01

Numerical techniques and codes for characterizing coal-combustion-operated MHD generators and diffusers are developed. The purpose for this activity is two-fold: (1) provide the MHD Division of the Department of Energy with evaluative guidelines in selecting and exercising channel codes; (2) provide users with codes to design MHD channels/diffusers and evaluate their performance. ERA

N78-28945# Oak Ridge National Lab., Tenn.
MEASURING THE ELECTRON HEAT DIFFUSION COEFFICIENT IN A TOKAMAK FROM SAWTOOTH OSCILLATION OBSERVATIONS
M. Soler and J. D. Callen Feb. 1978 42 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6165) Avail: NTIS HC A03/MF A01

A number of methods are discussed for determining the electron heat conduction coefficient chi/sub e/ in a Tokamak from the experimental observation of the space-time evolution of the temperature perturbations induced by internal disruptions. In the Oak Ridge Tokamak (ORMAK) the various average values of chi/sub e/ and the radial dependence of chi/sub e/ are found to be consistent with and more precise than the chi/sub e/ (r) determined by conventionally analyzing the electron power balance equation. The net result of these measurements is to conclusively prove that the dominant, radial electron heat transport mechanism in Tokamaks is a microscopic, diffusive process. ERA

N78-28946# General Atomic Co., San Diego, Calif.
GAC-ANL TNS SCOPING STUDIES. VOLUME 5: SUPPORT ENGINEERING, TRITIUM, AND NEUTRONICS Progress Report, 1 Oct. 1976 - 30 Sep. 1977
Jan. 1978 167 p refs
(Contracts EY-76-C-03-0167-038; W-31-109-eng-38)
(GA-A-14615-5-Vol-5; ANL/FPP-77-6) Avail: NTIS HC A08/MF A01

Efforts were directed primarily toward plasma support studies. Specifically, the studies included work on neutral beam and radio frequency heating schemes, vacuum pumping and tritium systems, superconducting E-coil design, materials evaluation, power supplies and blanket and shield design with emphasis on the numerical analysis of shield penetrations. All efforts considered two TNS options, i.e., the Ignition Test Reactor (ITR) and the Upgradable Ignition Test Reactor. The resulting designs and conclusions are therefore generally valid for most Tokamak reactor devices, ranging from the basic ignition test reactor to a more ambitious net power device. The superconducting E-coil design, on the other hand, is more design specific to the basic ITR device. ERA

N78-28947# General Atomic Co., San Diego, Calif.
GAC-ANL TNS SCOPING STUDIES. VOLUME 9: ENGINEERING SUPPORT STUDIES; SAFETY, REGULATORY CONSIDERATIONS Status Report, 1 Oct. 1976 - 30 Sep. 1977
Oct. 1977 170 p refs Prepared by Nuclear Services Corp.
(Contract EY-76-C-03-0167-038)
(GA-A-14614-Vol-9) Avail: NTIS HC A08/MF A01

The safety and regulatory requirements being considered for fusion devices are examined. The study begins with a comparative evaluation of fission and fusion devices. Succeeding sections of the study present a safety assessment, regulatory considerations, and design and siting criteria for fusion devices. The study results are based entirely on a conceptual design for a Tokamak magnetically confined experimental device to demonstrate fusion ignition. Only minor emphasis is provided to discuss the upgrade version, the fusion demonstration plant. ERA

N78-28948# United Technologies Research Center, East Hartford, Conn.
HIGH BETA CAPTURE AND MIRROR CONFINEMENT OF LASER PRODUCED PLASMAS Final Report
A. F. Haught, R. G. Tomlinson, W. B. Ard, L. R. Boedeker, T. L. Churchill, W. J. Fader, R. A. Jong, A. E. Mensing, D. H. Polk, and J. H. Stufflebeam Dec. 1977 92 p refs
(Contract EY-76-C-02-2277)
(COO-2277-11; UTRC/R-77-953600-28) Avail: NTIS HC A05/MF A01

Measurements of the lifetime of hot ions in a mirror confined warm plasma were carried out by observations of the hot ion buildup time obtained with energetic neutral beam injection. A cryocondensation pump was constructed and incorporated in the neutralizer chamber of the LITE neutral beam line. Calculations were carried out to evaluate the sizes and shapes of ambipolar potential modification produced by electron cyclotron resonance heated electrons and to determine the spatial distribution and densities of cold ions trapped in the potential wells. The effects of the spatial distribution of the cold ions on their effectiveness for stabilizing the drift cyclotron loss cone instability was studied numerically using the formulation of Pearlstein in which the

dispersion relation for the DCLC mode was solved for finite-size plasmas containing hot and cold components. ERA

N78-28949# Battelle Pacific Northwest Labs., Richland, Wash.
PACIFIC NORTHWEST LABORATORY REPORT ON FUSION ENERGY RESEARCH Progress Report, Apr. - Jun. 1977
Jul. 1977 44 p refs
(Contract EY-76-C-06-1830)
(BNWL-1939-8) Avail: NTIS HC A03/MF A01

The development of economic data for fusion power plants continued in a study estimating the potential impact of a shortage of materials important in fusion plant construction. In studies developing heat transfer and fluid flow design tools for fusion reactor blankets, preconceptual design studies were initiated to identify the potential design limits of water cooling in the first wall of Tokamak Next Step (TNS) concepts. In surface effects research clean gold samples were irradiated in the neutron source for a neutron sputtering experiment. Light ion and neutron irradiation experiments continued in studies of the effects of radiation on mechanical properties. Neutron irradiations of Ni, 316SS, and Nb wires and foils were completed. Work continues in studies developing acoustic emission (AE) techniques for determining the prebreakdown behavior and failure mechanisms in electric insulators with potential applications in fusion reactors. Scoping experiments with the high-vacuum dielectric breakdown apparatus were conducted. ERA

N78-28950# Princeton Univ., N. J. Plasma Physics Lab.
REVIEW OF PLASMA HEATING BY WAVES IN THE ION-CYCLOTRON RANGE OF FREQUENCIES
F. W. Perkins 1978 7 p refs Presented at the 3d Topical Conf. on Radio Freq. Plasma Heating, Pasadena, Calif., 10-14 Jan. 1978
(Contract EY-76-C-02-3073)
(CONF-780113) Avail: NTIS HC A02/MF A01

Three aspects of wave heating are reviewed. The many interesting physics phenomena are outlined which occur in this frequency regime and how they can be profitably utilized in Tokamak and other heating experiments is indicated. The key current theoretical problems are enumerated. The use of the ICRF program for Tokamak physics questions is shown. ERA

N78-28951# Battelle Pacific Northwest Labs., Richland, Wash.
TCT HYBRID PRECONCEPTUAL BLANKET DESIGN STUDIES
D. T. Aase, M. C. C. Bampton, T. J. Doherty, B. R. Leonard, R. A. McCann, D. F. Newman, R. T. Perry, and C. W. Stewart Jan. 1978 138 p refs
(Contract EY-76-C-06-1830)
(PNL-2304) Avail: NTIS HC A07/MF A01

The conceptual design of a Tokamak fusion-fission (hybrid) reactor, which produces electric power and fissile materials, is reported. Its core consists of a Tokamak plasma maintained in the two-component torus mode by both D and T beams and having a single null poloidal diverter. The blanket concept consists of a neutron multiplying converter region, containing natural uranium molybdenum slugs followed by a fuel burning blanket region of molten salt containing PuF3. An adequate first wall cooling method was determined, utilizing low pressure water in a double wall design. A conceptual layout of the converter region tubes was performed, providing adequate helium cooling and the desired movement of U-Mo slugs. ERA

N78-28952# California Univ., Livermore. Lawrence Livermore Lab.
ELECTROSTATICALLY DRIVEN PLASMA HYDRODYNAMIC INSTABILITY. 1: THE FAILURE OF VACUUM-INSULATED, LONG WAVELENGTH LASER FUSION PELLETS
C. D. Levermore, R. E. Caflisch, and L. L. Wood Oct. 1977 13 p Presented at the Am. Phys. Soc. Meeting, Atlanta, 7-11 Nov. 1977
(UCRL-79934; Conf-771136-31) Avail: NTIS HC A02/MF A01

Longer wavelength laser radiation generates relatively large fluxes of superthermal electrons that penetrate and preheat the cores of such pellets at early times in their implosion history, precluding their efficient subsequent compression. Separation of the outermost shell of such pellets from its inner regions by a vacuum layer is considered analytically and computationally. Results of such considerations are presented. The results developed also apply to a variety of formally similar phenomena, ranging from the relativistic edge of supernova photospheres to diode breakdown in REB machines. ERA

N78-28953# California Univ., Livermore. Lawrence Livermore Lab.
INERTIAL CONFINEMENT FUSION (ICF)
12 Oct. 1977 31 p Presented at the 19th Ann. Am. Phys. Soc. Meeting, Atlanta, 7-11 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-79856; Conf-771136-30) Avail: NTIS HC A03/MF A01

Rapid progress was made in the four major areas of ICF-targets, drivers, fusion experiments, and reactors. High gain targets were designed. Laser, electron beam, and heavy ion accelerator drivers appear to be feasible. Record-breaking thermonuclear conditions were experimentally achieved. Detailed diagnostics of laser implosions confirmed predictions of the LASNEX computer program. Experimental facilities are being planned and constructed capable of igniting high gain fusion microexplosions in the mid 1980's. A low cost long lifetime reactor design was developed. ERA

N78-28954# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
[EXPERIMENTAL AND THEORETICAL ACTIVITIES IN PLASMA PHYSICS] Annual Status Report, 31 Dec. 1976
Jul. 1977 92 p refs Sponsored jointly by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
Avail: NTIS HC A05/MF A01

Some aspects of toroidal magnetic confinement systems for fusion plasmas are dealt with. They include screw-pinch devices, turbulent heating experiment, gas blanket studies, and work on magnetohydrodynamics and transport theory. ESA

N78-28955# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
FUSION RESEARCH AT THE ROYAL INSTITUTE OF TECHNOLOGY IN STOCKHOLM 1978 Research and Training Programme on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
Bo Lehnert Jan. 1978 28 p refs
(TRITA-PFU-78-01) Avail: NTIS HC A03/MF A01

Research activities in plasma physics and controlled fusion during 1977 are summarized as are plans for research in 1978. The research program includes investigations on plasma-neutral gas interaction and stability, magnetic confinement being mainly produced by poloidal fields, plasma heating, and reactor technology. Author (ESA)

N78-28956# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
THE SWEDISH FUSION RESEARCH PROGRAMME ON MAGNETIC CONFINEMENT 1978 Research and Training Programme on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
Bo Lehnert Feb. 1978 65 p refs Sponsored by European Communities
(TRITA-PFU-78-02) Avail: NTIS HC A04/MF A01

Activities and plans for research on plasma physics and controlled fusion at the Royal Institute of Technology in Stockholm are reviewed, with descriptions and motivations of the research lines being conducted. These activities include investigations on plasma-neutral gas interaction, development of special principles for plasma stabilization, magnetic confinement schemes based mainly on poloidal fields, and the generation, heating, and diagnostics of plasmas impermeable to neutral gas.Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N78-28957 Texas Univ., Austin.
ELECTRODELESS AND FOUR-PROBE DOUBLE ac HALL EFFECT MEASUREMENTS ON ALKALI METAL-AMMONIA SOLUTIONS Ph.D. Thesis
Richard Dale Swenumson 1977 127 p
Avail: Univ. Microfilms Order No. 78-07394

A systematic study of the Hall effect in alkali metal-ammonia (M-NH3) solutions at the metal-nonmetal (M-NM) transition completed. Data were taken on Li, Na, K and Cs-NH3 solutions, as well as alloys of Li and Na in ammonia. Measurements were made in the concentration range of 1 - 12 MPM (mole percent metal) at temperatures between -33 and -55 C. A conventional double arc four-probe method as well as an entirely new double ac technique were used and are described. In each case, the Hall effect causes a current which is detected by an inductive pickup. The signal is proportional to the Hall mobility. These methods are described and compared to other Hall techniques and measurements. All data taken were consistent from one technique to another. Neither theory appears to contain an explanation of the excess mobility found in Na-NH3 solutions. Dissert. Abstr.

N78-28958 Illinois Univ. at Urbana-Champaign, Urbana.
PARAMAGNETIC RESONANCE STUDIES OF TRIVALENT DYSPROSIUM AND CERIUM IN THE CUBIC HOST DICESIUM SODIUM YTTRIUM HEXACHLORIDE Ph.D. Thesis
Gordon Edward Fish 1978 154 p
Avail: Univ. Microfilms Order No. 78-11233

X-band electron paramagnetic resonance was used to study octahedrally coordinated rare earth ions in the host lattice Cs2NaYCl6. In order to test various models of the orbit-lattice interaction, the spin-lattice relaxation rate of Dy:Cs2NaYCl6 was measured as a function of temperature and direction of the applied dc magnetic field. Electron nuclear double resonance (ENDOR) studies were made with Ce:Cs2NaYCl6 to study ligand coupling to the paramagnetic impurity. Resonance with resolved structure were seen from Cs-133 and Na-23. The Cs-133 resonance showed isotropic structure arising from a Fermi contact hyperfine interaction. A multi-line anisotropic structure was seen in the Na-23 ENDOR spectrum, with splittings several times as large as that expected for a purely point dipolar coupling between Ce(3+) and the nearest Na ion. Dissert. Abstr.

N78-28959 Michigan State Univ., East Lansing.
DE HAAS-VAN ALPHEN STUDY OF AuGa2 ALLOY PHASE Ph.D. Thesis
John Jesse Higgins 1977 248 p
Avail: Univ. Microfilms Order No. 7810064

The de Haas-van Alphen frequency (F) of the third zone neck orbit (C prime sub 3), the Dingle temperature (T sub d), and the residual resistance ratio (RRR) of the intermetallic compound AuGA2 were measured on samples cut from the top, middle, and bottom of three single crystals to see if these parameters vary over the range of composition in which the fluorite structure exists. F ranged from 3388 kG to 3384.2 kG to 3405.7 kG. Assumption of the rigid band model implies for these samples a concentration range about stoichiometry less than .06 at .% Ga. But analogy to the case of Pd impurity associates a value between .22 and .43 at .% Ga with the range of F. Stoichiometry does not coincide exactly with the congruent point. The dHvA phase constant was found to be .46 + or - .09. RRR and TD varied from 55 to 1800 and from 5.0 to 1.1 K, respectively. Dissert. Abstr.

N78-28960 Illinois Univ. at Urbana-Champaign, Urbana.
STUDIES OF THE OPTICAL PROPERTIES OF SOLIDS. 1: TWO-PHOTON ELECTROABSORPTION. 2: ELECTRON-HOLE EXCHANGE COUPLING AT L SUB II, III EDGES Ph.D. Thesis
Michael Allen Kolber 1978 168 p
Avail: Univ. Microfilms Order No. 7811257

Direct-gap covalent semiconductors, such as GaAs, are evaluated employing exciton theory; the resulting line shapes are shown to be proportional to the lineshapes for one-photon forbidden transitions. Exchange mixes the soft X-ray absorption edges of metallic Na, Mg, and Al, affecting the detailed absorption lineshape and the LII/LIII intensity ratio. The Onodera theory of this mixing is generalized and the requirements of particle conservation and causality lead to significant modifications of the theoretical absorption lineshape. It is shown that under certain conditions an exchange-free lineshape can be extracted from experimental data for comparison with non-asymptotic theories of X-ray edges. Dissert. Abstr.

N78-28961 Illinois Univ. at Urbana-Champaign, Urbana.
PHONON THERMAL TRANSPORT IN METALLIC GLASSES BELOW 100 K Ph.D. Thesis
James Regis Matey 1978 110 p
Avail: Univ. Microfilms Order No. 78-11265

The temperature dependence and magnitude of phonon thermal conductivity of metallic glasses display a similarity to those properties in nonmetallic glasses. Sound velocity measurements on a glassy palladium silicon alloy likewise demonstrate a qualitative similarity with the behavior of nonmetallic glasses. These findings indicate that the localized excitations responsible for the anomalous behavior of nonmetallic glasses are also present in metallic glasses. The density of the two-level systems PdSi rods was manipulated by heat treatment. Both the plateau regime and the equivalent sq T regime in the phonon thermal conductivity were affected in the same way. The test data and tunneling-states model of the localized excitations were quantitatively compared. Dissert. Abstr.

N78-28962 Kansas State Univ., Manhattan.
FOUR BEAM ANOMALOUS X-RAY TRANSMISSION OF CuKa X-RAYS IN ELASTICALLY BENT ASYMMETRIC SILICON CRYSTALS Ph.D. Thesis
Michael Dave Shaw 1977 113 p
Avail: Univ. Microfilms Order No. 78-11441

Utilizing a two element silicon (220) beam-splitting front crystal (Laue case) in an otherwise conventional vertical double crystal spectrometer, the four diffracted intensities of the anomalously transmitted and diffracted X-ray beams from both sides of the (220) planes of silicon samples can be examined simultaneously. Transmission rocking curves for three thick silicon (220) crystals having asymmetry angles of 0.46 deg, 2.52 deg, and 5.66 deg (all plus or minus 0.1 D) were obtained for various applied bending moments. The curvatures of the bent asymmetric crystals were measured directly from the relative peak shifts of the rocking curves. Dissert. Abstr.

N78-28963 Massachusetts Univ., Amherst.
PHASE TRANSITIONS IN COMPRESSIBLE TWO-DIMENSIONAL ISING MODELS Ph.D. Thesis
Thomas John Slavkovsky 1978 148 p
Avail: Univ. Microfilms Order No. 7810755

A model is presented which allows for both first- and second-order transitions in a compressible ferromagnetic insulator. As with the Baker-Essam model, the exchange interaction depends upon the instantaneous position of the Ising spins, but the lattice is treated as an elastic continuum to provide stability against shear forces. The formulation leads to a spin cumulant expansion, with the physics contained in a long-range four-spin interaction mediated by a two branch Debye spectrum of phonons. The first-order cumulant was developed using exact expressions for spin-spin correlation functions found from thermodynamic Green's function techniques of Kadanoff. The form of the second order term was found using the same methods as well as Kadanoff's operator algebra. Critical behavior was either second-order or tri-critical depending upon the elastic parameters of the system. Dissert. Abstr.

N78-28964 Michigan State Univ., East Lansing.
THE MAGNETOTHERMOELECTRIC EFFECT IN SINGLE CRYSTAL ALUMINUM AND INDIUM AT LIQUID HELIUM TEMPERATURES Ph.D. Thesis
Barry Jay Thaler 1977 167 p
Avail: Univ. Microfilms Order No. 78-10122

The effect of a transverse magnetic field upon the low temperature absolute thermopower of very dilute aluminum and indium based alloys was studied. Measurements were carried out on single crystal samples at temperatures T between 1.5 and 5K and with magnetic field strengths up to 20kG. The size of the oscillatory component due to oscillations in the density of

states at the Fermi energy is estimated for H along the (010) axis for both the beta-orbit in aluminum and the neck orbit of the beta-arms in indium. These oscillations are interpreted as being caused by magnetic breakdown. Dissert. Abstr.

N78-28965 Utah Univ., Salt Lake City.
A THEORY OF PERTURBED-PHONON EFFECTS IN OFF-CENTER-DEFECT TUNNELING Ph.D. Thesis
Davis Loel Tonks 1978 235 p
Avail: Univ. Microfilms Order No. 78-11016

The transition-rate theory of the polaron-like motion of substitutional off-center ionic defects between two localized states was extended to include the defect-lattice coupling term quadratic in ion displacements and momenta. A diagram formalism was developed to include the effects of phonon perturbation on the transition rate assuming a single tunneling. A Holstein-like approximation to the transition rate, valid at high temperatures, and an approximation involving single phonon processes thought to be valid at low temperatures were made. Integral equations formally summing all orders of phonon processes were written but not solved. The theory was specialized to RbCl:Ag(+) and calculations were performed. Dissert. Abstr.

N78-28966 British Library Lending Div., Boston Spa (England).
PREPARATION AND PROPERTIES OF Eu2O3 SINGLE CRYSTALS
A. M. Lejus, J. Cl. Bernier, and R. Collongues 2 Sep. 1977 10 p refs Transl. into ENGLISH from Rev. Int. des. Hautes Temp. Refract., vol. 13, 1976 p 25-29
(BLL-CE-Trans-7212-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Single crystals of europium oxide Eu2O3 of large size and B monoclinic structure were prepared by the Verneuil (flame fusion) method. Characteristics which are affected by the structural anisotropy were studied including cleavage property, microhardness, magnetic susceptibility and aptitude for hydration. A.R.H.

N78-28967 North Carolina Univ., Chapel Hill.
AN INTERNAL FRICTION STUDY OF IMPURITY DEFECT-DISLOCATION INTERACTIONS IN AgBr:Cd (++) AND AgBr:Sr (++) SINGLE CRYSTALS Ph.D. Thesis
Sherra Elizabeth Horan 1977 132 p
Avail: Univ. Microfilms Order No. 78-07138

A series of internal friction experiments on silver bromide doped with cadmium and varying amounts of strontium are analyzed. The time-dependent recovery of the decrement after its perturbation by high amplitude oscillatory stress indicated that cadmium pins diffuse somewhat into the bulk crystal, while strontium pins remain on the dislocation core during the perturbation. Data exhibiting a low strain amplitude peak in samples annealed for long times at room temperature are discussed in terms of a qualitative model involving the dissociation of aggregates by applied stress. Results indicate that strontium segregates more strongly to dislocations than does cadmium and forms several different aggregates on the dislocation core. Dissert. Abstr.

N78-28968 Louisiana State Univ. and A&M Coll., Baton Rouge.
DIFFUSION OF ARSENIC IN DEGENERATE SILICON: A QUASI-STATIC APPROACH Ph.D. Thesis
Rituparna Shrivastava 1977 181 p
Avail: Univ. Microfilms Order No. 78-07559

A model for arsenic diffusion in silicon is proposed which takes into account the degeneracy of the carriers, partial ionization of the impurities, single acceptor level vacancies and the internal electric field. The transport process for holes, electrons, and impurities is described by the flux equations, the continuity equations and Gauss' law. The resulting partial differential equations are highly nonlinear, and a numerical scheme was used to solve the problem. An efficient computer program based on a quasi-linearization technique was written to obtain the impurity profiles from the processing data. It is found that the internal electric field enhances diffusion at high concentrations. Dissert. Abstr.

N78-28969*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DETERMINATION OF BULK DIFFUSION LENGTHS FOR ANGLE-LAPPED SEMICONDUCTOR MATERIAL VIA THE SCANNING ELECTRON MICROSCOPE: A THEORETICAL ANALYSIS
Oldwig VonRoos 31 May 1978 23 p refs Prepared for DOE
(Contract NAS7-100)
(NASA-CR-157352; JPL-Pub-78-47; DOE/JPL-1012-78/8)
Avail: NTIS HC A02/MF A01 CSCL 20C

A standard procedure for the determination of the minority carrier diffusion length by means of a scanning electron microscope (SEM) consists in scanning across an angle-lapped surface of a P-N junction and measuring the resultant short circuit current I sub sc as a function of beam position. A detailed analysis of the I sub sc originating from this configuration is presented. It is found that, for a point source excitation, the I sub sc depends very simply on x, the variable distance between the surface and the junction edge. The expression for the I sub sc of a planar junction device is well known. If d, the constant distance between the plane of the surface of the semiconductor and the junction edge in the expression for the I of a planar junction is merely replaced by x, the variable distance of the corresponding angle-lapped junction, an expression results which is correct to within a small fraction of a percent as long as the angle between the surfaces, 2 theta sub 1, is smaller than 10 deg. Author

N78-28970# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ON THE USE OF PHOTOACOUSTIC CELL FOR INVESTIGATING THE ELECTRON-PHONON INTERACTION IN SEMICONDUCTORS
C. C. Ghizoni, M. A. A. Siqueira, H. Vargas (Univ. Estad. de Campinas), and L. C. M. Miranda (Univ. Estad. de Campinas) Dec. 1977 16 p refs Submitted for publication
(INPE-1193-PE/110) Avail: NTIS HC A02/MF A01

The usefulness of the photoacoustic cell for studying the transport properties of semiconductors is demonstrated. This technique separates the different sources of sound generation in a semiconductor. Specific application is made for the case of Si crystals submitted to rectangular voltage pulses. G.G.

N78-28971# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
TEMPERATURE DEPENDENCE OF THE MAGNETIZATION IN MICROCRYSTALS
K. SkeffNeto (Univ. de Brasilia, Brazil), I. C. daCunhaLima (Univ. Estad. de Campinas), N. S. Almeida (Univ. Estad. de Campinas), and L. C. M. Miranda May 1978 5 p refs Submitted for publication
(INPE-1259-PE/135) Avail: NTIS HC A02/MF A01

A simple molecular-field model taking into account the characteristic volume distribution of an assembly of magnetically ordered microcrystals is developed to explain the observed high temperature behavior of the magnetization. It is also shown that the volume distribution implies a distribution of critical temperatures. Author

N78-28972# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.
CLUSTER MODEL INVESTIGATION OF DEFECTS IN SOLIDS Final Technical Report, 1 Feb. 1975 - 31 Jan. 1977
George W. Pratt Apr. 1978 181 p refs
(Contract N00014-75-C-0785)
(AD-A053584) Avail: NTIS HC A09/MF A01 CSCL 20/12

The SCF-X alpha method has been applied to the study of crystalline defects. First the LiF molecule was studied. The X alpha method gave the correct internuclear separation and vibrational frequency. This work was extended to the LiF crystal via a cluster treatment. The correct lattice constant was derived and the electronic structure was in agreement with experiment. The final phase of the work dealt with the removal of an F(-) ion creating an F minus center. The X alpha minus cluster method gave a good description of this defect. Author (GRA)

N78-28973# Hughes Research Labs., Malibu, Calif.
CHARACTERIZATION AND ANALYSIS OF INDIUM-DOPED SILICON EXTRINSIC DETECTOR MATERIAL
James Baukus, T. McGill (California Inst. of Technol., Pasadena), and L. Forbes (California Univ., Davis) Dec. 1977 117 p refs
(Contract DAAK70-77-C-0082)

(AD-A053438; ITR-1) Avail: NTIS HC A06/MF A01 CSCL 17/5

This first six-month report of a one-year program describes progress made in analyzing Si:In detector material. Hall-effect, photoluminescence, and IRFET measurements have been made in order to characterize the x level and attempt to determine its nature. Author (GRA)

N78-28974# Massachusetts Inst. of Tech., Cambridge.
AMORPHOUS-SEMICONDUCTOR JUNCTION EFFECTS Final Report, 1 Jan. 1974 - 31 Dec. 1977
David Adler 10 Apr. 1978 12 p refs
(Contract DAAG29-74-C-0006)
(AD-A054647; ARO-11575.9-P) Avail: NTIS HC A02/MF A01 CSCL 20/12

Heterojunctions between amorphous semiconductors and crystalline semiconductors have been investigated in detail. In particular, chalcogenide-glass/n-Si, chalcogenide-glass/p-Si, chalcogenide-glass/a-Si, and chalcogenide glass/n-GaAs heterojunctions were fabricated and analyzed. Band models which explain the electronic and optical behavior have been derived. It was shown that these band models remain valid when the chalcogenide glasses are switched into the on state. A transistor was fabricated in which the glass served as the emitter. The current gain increases by a factor of about 1000 when the glass is switched. These results together with pulse studies resulted in a complete analysis of the threshold switching and recovery processes. Author (GRA)

N78-28975# California Univ., Los Angeles. Dept. of Chemistry.
THE TWO-PHOTON EXCITATION SPECTRUM OF TRIPHENYLENE IN n-HEPTANE SINGLE CRYSTALS
Anne-Marie Merle, Alan Campion, and M. A. El-Sayed 19 Apr. 1978 15 p refs Submitted for publication
(Contract N00014-75-C-0602)
(AD-A054668; TR-29) Avail: NTIS HC A02/MF A01 CSCL 20/12

A comparison of the one- and two-photon absorption spectra of triphenylene in n-heptane single crystals at 1.6 K reveals that the lowest singlet state is of (1)A(1) symmetry while the second singlet state as (1)A(2) symmetry, in contradiction with the commonly accepted assignment. Author (GRA)

N78-28976# California Univ., Berkeley. Lawrence Berkeley Lab.
EXCITED STATE ELECTRON SPIN COHERENCE (ESESC) STUDIES OF TRIPLET STATES IN MOLECULAR SOLIDS
M. E. Tarrasch Feb. 1978 110 p refs
(Contract W-7405-eng-48)
(LBL-7370) Avail: NTIS HC A06/MF A01

The field of coherent spectroscopy of two-level systems was applied to the lowest triplet state of organic molecules. By neglecting the triplet sublevel not coupled by the field, it was possible to describe the remaining two levels with Feynman-Vernon-Hellwarth geometrical representation of a general two level system. The equations of motion of the pseudomagnetization were derived after transformation to the rotating frame, as were Bloch-type equations which include phenonomenological relaxation times. The loss of coherence due to exchange between triplet states with different Larmor frequencies but identical zero-field dipolar tensor axes was examined. By writing two sets of coupled Bloch equations, expressions for the effective decay rate and frequency shift of the experimentally monitored triplet system was derived and discussed in the limits of slow and rapid exchange. This analysis was applied to intramolecular tunneling between different configurations of cyclopentanone. ERA

N78-28977# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazioni.
BAND-GAP PHOTOREFLECTANCE SPECTRA OF SbSI NEAR THE PHASETRANSITION TEMPERATURE
S. M. Efendiev (S.M. Kirov Azerbaijan State Univ., Baku), M. Grandolfo, C. Ranghiasci, and P. Vecchia 1977 16 p refs Presented at the 4th Intern. Meeting on Ferroelec. (IMF4), Leningrad, 18-23 Sep. 1977
(ISS-P-77/8) Avail: NTIS HC A02/MF A01

Photoreflectance spectra of the semiconducting ferroelectric compound SbSI are presented at wavelengths around the energy gap region and at temperature near the Curie temperature. The mechanism for the photoreflectance effect in this compound is discussed. The temperature dependence of spectra was also investigated. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

No abstracts in this category.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N78-28978 Texas Univ. at Arlington.
A LEAST COST INSTRUMENTATION LOCATION PROBLEM Ph.D. Thesis
Subhash Chandra Singhal 1977 236 p
Avail: Univ. Microfilms Order No. 78-08309

The location of cinetheodolites used in testing missiles is considered. The problem is to find the collection of sites and to determine what type of instruments should be assigned to the various sites selected so as to meet the requirements at minimum cost. An error function is derived that gives an estimate of the instrument error and its relation to various parameters which effect the error in locating the target. The original problem is solved iteratively in two stages. At each stage, an integer programming problem is formulated to partially satisfy the requirements of that stage. The optimal solution of this formulated problem is checked to see if the remaining requirements of that stage are satisfied. If the requirements are not met additional constraints are appended and the problem is solved iteratively. Dissert. Abstr.

N78-28979*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROJECT PLAN FOR JOINT FAA/NASA HEAD-UP DISPLAY CONCEPT EVALUATION
R. F. Haines Aug. 1978 16 p Sponsored in part by DOT
(NASA-TM-78512; HUD-1; A-7562) Avail: NTIS HC A02/MF A01 CSCL 05A

Head-Up Display (HUD) concept for large commercial turbojet transport aircraft is considered for the its contribution to aviation safety in the form of improved performance during the approach and landing phase flight. The basic reearch areas represent fundamental questions that are still unresolved and which were considered important to the effective use of the HUD by pilots. Project documentation and management responsibilities are outlined. G.G.

N78-28980# Air Force Logistics Command, Wright-Patterson AFB, Ohio. Directorate of Management Sciences.

LOGISTIC MANAGEMENT BY WEAPON SYSTEM
Jack H. Gambill and Ken Sinclair Apr. 1977 56 p refs
(AD-A053382; AFLC/XRS-76-11) Avail: NTIS HC A04/MF A01 CSCL 15/5

Headquarters Air Force requested the Air Force Logistics Command (AFLC) conduct a study to determine the feasibility of quantifying the resource impact of deleting particular weapon systems for the Air Force inventory. Therefore, the purpose of this study was: (1) review the extent of weapon system visibility within the existing AFLC requirements data systems, and (2) conceptualize a management information system that would quantify (in a timely manner) the impact on AFLC managed and/or controlled resources due to a significant change in the force composition or weapon/support system capability. The study concentrated on the five areas that displayed the greatest potential for weapon system forecasting: (1) Aircraft Modifications, (2) Aircraft Replenishment Spares and Repair Parts, (3) Aircraft Initial Spares and Repair Parts, (4) Depot Purchased Equipment Maintenance, and (5) Civilian Personnel. GRA

N78-28981# Air Force Logistics Command, Wright-Patterson AFB, Ohio.
LOGISTIC IMPACT OF LONGER C-5 MISSIONS
D. L. Casey May 1977 60 p refs
(AD-A053381; AFLC-TR-76-16) Avail: NTIS HC A04/MF A01 CSCL 01/3

This study was undertaken to determine the impact and savings to accrue from maximum commitment to longer C-5 missions (perhaps 15-17 hours) using inflight refueling. This was accomplished by reviewing maintenance writeup data for shorter flights versus longer flights. Traditional logistics forecasting techniques are based on the number of flying hours. Therefore, a change in sortie length would not be expected to impact on logistics requirements unless the overall number of flying hours changed. An examination of this relationship was undertaken in this study. It was found that the occurrence of a sortie tends to result in a given number of maintenance writeups regardless of the length of the sortie. Author (GRA)

N78-28982# Naval Research Lab., Washington, D. C. Radar Div.
A USER-ORIENTED MANAGEMENT PROGRAM FOR PROJECT MONITORING ON A TIME-SHARE COMPUTER TERMINAL Interim Report
Clifford L. Temes Jan. 1978 21 p
(ZF12151001)
(AD-A053386; AD-E000132; NRL-MR-3706) Avail: NTIS HC A02/MF A01 CSCL 05/1

This report describes a (FORTRAN) management computer program for monitoring technical progress and expenditures on a time-share terminal. The program is written for use on the DEC-10 computer at NRL. A basic feature of the output is a plot of actual past expenditures combined with estimated future expenditures, along with other project information such as technical milestones, major procurements and staffing.
Author (GRA)

N78-28983# Applied Science Associates, Inc., Valencia, Pa.
TSM GUIDE TO TRAINING DEVELOPMENT AND ACQUISITION FOR MAJOR SYSTEMS Final Report, May - Dec. 1977
Vernon L. Hanson and George R. Purifoy, Jr. Mar. 1978 100 p refs
(Contract DAHC19-77-C-0016; DA Proj. 2Q2-63731-A-770)
(AD-A053489; ASA-485; ARI-TR-78-A7) Avail: NTIS HC A05/MF A01 CSCL 15/5

New emphases are placed on the integration of subsystem developments into the materiel acquisition process for major Army systems. This guidebook describes and illustrates how training development and acquisition activities fit into the Life Cycle System Management Model (LCSMM) for total system development. Section 1 discusses the need for integrated subsystem development and identifies the main elements of the 'systems approach.' Section 2 presents a generalized training developments model, based on the ISD. Section 3 outlines the LCSMM. Major milestone events and activities are briefly described and discussed. Section 4 integrates training development activities with the total system acquisition process and sketches the role of the TRADOC System Manager (TSM) for the conduct and coordination of these activities. Author (GRA)

N78-28984# Tetra Tech, Inc., Arlington, Va.
US NAVY ENERGY R AND D PROGRESS, 1977
Mar. 1978 160 p
(Contract N00014-77-C-0350)
(AD-A053428; TETRAT-A-938-78-361) Avail: NTIS HC A08/MF A01 CSCL 05/1

This U.S. Navy Energy R and D Progress report summarizes the progress of the Navy Energy R and D program from October through December 1977 and progress prior to October 1977 which had not previously been documented. Potential energy savings for each project is included. Author (GRA)

N78-28985# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
OPTIMAL CONTROL OF MULTI-SHOP SYSTEMS. PART 1: PARALLEL SHOPS. PART 2: SERIES SHOPS
Christopher Brooks Haas and Thom J. Hodgson Apr. 1978 60 p refs
(Contract N00014-76-C-0096)
(AD-A053599; RR-78-4-Pt-1; RR-78-4-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 12/2

This paper considers the optimal control structure for multi-shop (Part I: Parallel, Part II: Series) systems, where the input to the shop system is random and the shop output is determined by the number of workers in the shop. The number of workers available to the system is held constant, while control is exercised in discrete time by adjusting the allocation of workers to the various shops in the system. There is a cost for transferring workers. Additionally, there is a cost of holding backlog in the system. The control objective is to minimize the sum of these costs over an infinite horizon. It is shown that for some regions of the system's state space the optimal control policies are known exactly without resorting to computational methods. For other regions it is shown that the problem can be decomposed into subproblems of reduced complexity. Finally, an inertia (hysteresis) property is established which reduces the number of policy combinations which must be considered in some cases, and completely eliminates the necessity to determine policy in other cases. The net result is a substantial reduction in the computer storage and computational effort required to solve for the optimal control policy. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N78-28986*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BIBLIOGRAPHY OF LEWIS RESEARCH CENTER TECHNICAL PUBLICATIONS ANNOUNCED IN 1977
Washington May 1978 348 p
(NASA-TM-78918; E-9449-2) Avail: NTIS HC A15/MF A01 CSCL 05B

This compilation of abstracts describes and indexes over 780 technical reports resulting from the scientific and engineering work performed and managed by the Lewis Research Center in 1977. All the publications were announced in the 1977 issues of STAR (Scientific and Technical Aerospace Reports) and/or IAA (International Aerospace Abstracts). Documents cited include research reports, journal articles, conference presentations, patents and patent applications, and theses. A.R.H.

N78-28987# Applied Communication Research, Inc., Stanford, Calif.
DEVELOPMENT OF A METHODOLOGY TO ASSESS THE HEALTH OF THE STI COMMUNITY IN THE U.S.
Colin K. Mick and Richard H. Miller Nov. 1977 322 p refs
(Grants NSF C-76-15515; NSF SIS-75-12921)

(PB-278749/7) Avail: NTIS HC A14/MF A01 CSCL 05B

An objective was empirical methodology for assessing the health of the STI community and to apply that methodology to develop an initial assessment. The focus of the project was modified to stress the development of a perspective from which to view the diverse nature of this field. Three primary assessment areas were identified--the environment within which the STI community operates, a description of the STI enterprise itself, and management, coordination and control activities in STI. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N78-28988*# Washington Univ., Seattle. Dept. of Civil Engineering.

EXECUTIVE SUMMARY: BENEFIT-COST EVALUATION OF AN INTRA-REGIONAL AIR SERVICE IN THE BAY AREA AND A TECHNOLOGY ASSESSMENT OF TRANSPORTATION SYSTEM INVESTMENTS Technical Report, 1 Jan. 1977 - 31 Mar. 1978

Lonnie E. Haefner 31 Mar. 1978 37 p ref

(Grant NsG-2170)

(NASA-CR-152154-1) Avail: NTIS HC A03/MF A01 CSCL 05C

The benefits and costs that would result from an intra-regional air service operation in the San Francisco Bay area were determined by utilizing an iterative statistical decision model to evaluate combinations of commuter airport sites and surface transportation facilities in conjunction with service by a given commuter aircraft type in light of area regional growth alternatives and peak and off-peak regional travel patterns. The model evaluates such transportation option with respect to criteria of airline profitability, public acceptance, and public and private non-user costs. In so doing, it incorporates information on modal split, peak and off-peak use of the air commuter fleet, terminal and airport costs, development costs and uses of land in proximity to the airport sites, regional population shifts, and induced zonal shifts in travel demand. The model is multimodal in its analytic capability, and performs exhaustive sensitivity analysis. A.R.H.

N78-28989*# Washington Univ., Seattle. Dept. of Civil Engineering.

A TECHNOLOGY ASSESSMENT OF TRANSPORTATION SYSTEM INVESTMENTS

Lonnie E. Haefner 31 Mar. 1978 206 p refs

(Grant NsG-2170)

(NASA-CR-152154-2) Avail: NTIS HC A10/MF A01 CSCL 05C

An abstract technology assessment format, capable of generic evaluation over a heirarchy of city sizes, shapes and modal transportation technology characteristics, using unit cost and impact data is presented. The formal analytic model used is Markovian decision theory. The analyst is not required to know or explore the historical data characteristics of the region in depth and can, therefore, rapidly examine sensitivities and boundaries of rational or optimal transportation investments. This examination may occur over a group of similar or different regions, and may draw significant conclusions about the mix of transportation technology investments most likely needed and capable of compatible operation. A.R.H.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N78-28990# Committee on Energy and Natural Resources (U. S. Senate).

IMPLEMENTATION OF PUBLIC LAW 95-87

Washington GPO 1978 170 p refs Hearing before Subcomm. on Public Lands and Resources of the Comm. on Energy and Natural Resources, 95th Congr., 2d Sess., 24 Apr. 1978

(GPO-28-863; Publ-95-122) Avail: Subcomm. on Public Lands and Resources

A hearing to review the implementation of the Federal Surface Control and Reclamation Act is presented. Testimony is heard from heads or their representatives of four Federal agencies regarding the problems they were experiencing in carrying out their responsibilities for implementing the surface mining program. An economic analysis and an environmental impact report are given to assess the program. G.Y.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N78-28991 Texas Univ. at Austin.

THE FATE OF SOLIDS-INCORPORATED POLIOVIRUS DURING CONTINUOUS, HIGH-RATE ANAEROBIC AND AEROBIC DIGESTION Ph.D. Thesis

Dee Ann Sanders 1977 143 p

Avail: Univ. Microfilms Order No. 78-07377

The effect of the anaerobic and aerobic digestion processes on solids-incorporated poliovirus was investigated. Polio type 1 (CHAT) was incorporated into activated sludge by aerating the sludge for 15 minutes to effect maximal practical uptake of virus into the sludge solids. The virus-laden sludge was introduced into 2 liter acclimated bench-scale anaerobic and aerobic digesters, and virus recovery was monitored frequently during one detention period of the digesters or until virus could no longer be detected. The effects of temperature and detention time on loss of virus infectivity during anaerobic and aerobic digestion were evaluated as well as the effects of solid loading to the anaerobic system. Recovery of virus infectivity during both aerobic and anaerobic digestion was affected by the temperature in the digester. Dissert. Abstr.

N78-28992*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ANALYSIS OF DOT NEAR-TERM TRANSPORTATION RESEARCH, DEVELOPMENT, AND DEMONSTRATION ACTIVITIES

Laura E. Baker, David W. Humphreys, and Donald L. Vairin 15 May 1978 175 p refs Prepared for DOT

(Contract NAS7-100)

(NASA-CR-157341; JPL-Pub-78-49) Avail: NTIS HC A08/MF A01 CSCL 13F

The transportation complex of the Nation is divided into six modes. The activities for each of those modes are presented by technology goals and objectives. The transportation trends of the Nation, for each of these modes, were analyzed through a number of studies and the data derived from these studies were used to establish key factors in guiding the strategy of planning near-term research, development, and demonstration activities. Information regarding the responsible agency within the Department of Transportation, program funding, and scheduling for each of the planned activities is presented. G.G.

N78-28993*# Operations Research, Inc., Silver Spring, Md.

PHASE 1: DEFINITION OF INTERCITY TRANSPORTATION COMPARISON FRAMEWORK. VOLUME 1: SUMMARY Final Report

19 Jul. 1978 42 p refs

(Contract NAS2-9815)

(NASA-CR-152152-Vol-1; ORI-TR-1298-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 13F

A unified framework for comparing intercity passenger and freight transportation systems is presented. Composite measures for cost, service/demand, energy, and environmental impact were determined. A set of 14 basic measures were articulated to form the foundation for computing the composite measures. A

parameter dependency diagram, constructed to explicitly interrelate the composite and basic measures is discussed. Ground rules and methodology for developing the values of the basic measures are provided and the use of the framework with existing cost and service data is illustrated for various freight systems. A.R.H.

N78-28994*# Operations Research, Inc., Silver Spring, Md.
PHASE 1: DEFINITION OF INTERCITY TRANSPORTATION COMPARISON FRAMEWORK. VOLUME 2: METHODOLOGY Final Report
19 Jul. 1978 251 p refs
(Contract NAS2-9815)
(NASA-CR-152152-Vol-2; ORI-TR-1298-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 13F

Categories of cost and service measures that will appropriately define the characteristics of all intercity transportation systems were established. Previous methods of comparing transportation systems were reviewed. Specific comparison variables, applicable to all modes were defined, and the functional relationships by which these variables are interdependent were explored. A framework by which the set of variables may be employed for comparison of data from the individual systems was constructed. A.R.H.

N78-28995# Arizona State Univ., Tempe. Dept. of Industrial Engineering.
WATER CONSERVATION: RESIDENTIAL IMPACTS M.S. Thesis
Donald E. Warner Jun. 1977 121 p refs
(AD-A053522) Avail: NTIS HC A06/MF A01 CSCL 13/2

The purpose of this study was to determine the constraints and mis-understandings associated with residential water conservation and to analyze the actual savings in dollars, water and energy that are achieved by the selection and installation of water conserving facilities. Residential water conservation programs have only been implemented during crisis or emergency situations. However, the recent awareness on the part of the American public, primarily due to the deterioration of energy resources, has focused greater attention on the interrelationships between water and energy. Research is undertaken to determine the potential constraints to a residential water conservation program and the reasons for conserving water. An analysis of various water conserving facilities is developed and applied to a residential area with an estimate of savings in dollars, water and energy. Additional impacts are reviewed as a result of this residential conservation program. Author (GRA)

N78-28996# Northwestern Univ., Evanston, Ill.
THE IMPACTS OF VEHICLE CONTROL POLICIES ON THE SHORT RUN COSTS OF CARRIERS: STATE STREET TRANSITWAY, A CASE STUDY M.S. Thesis
John Vincent Madden Jun. 1977 111 p refs
(AD-A053525) Avail: NTIS HC A06/MF A01 CSCL 15/5

This thesis investigates two vehicle control policies utilized to restrict delivery vehicles in the vicinity of downtown shopping malls. The two policies analyzed are complete vehicle prohibition from the mall, and time-restricted access to the mall by delivery vehicles. Under the time-restricted policy, delivery vehicles would be prohibited from entering the mall during the times of peak pedestrian and transit vehicle flow. The impacts of these policies which are of prime concern to carriers relate directly to the increased time necessary to perform a given number of deliveries as a result of these policies. This reduced productivity results in an increase in the short run costs of the carriers. The proposed mall/transitway for State Street in Chicago was selected as a case study. Author (GRA)

N78-28997# Philadelphia Electric Co., Pa.
EVALUATION OF THE ECONOMICAL AND TECHNOLOGICAL VIABILITY OF VARIOUS UNDERGROUND TRANSMISSION SYSTEMS FOR LONG FEEDS TO URBAN LOAD AREAS Final Report
Dec. 1977 365 p refs
(Contract EX-76-C-01-2055)
(HCP/T2055-1) Avail: NTIS HC A16/MF A01

The technical and economic suitability of many of the underground power transmission systems that may be available in the 1990's was evaluated. The systems considered included cellulose, polyproplyen, and gas insulated cables, oil filled cables, and cryogenic cables for 345 kV to 765 kV ac or dc systems and superconducting cables for 320 kV ac systems and 300 kV dc systems. The results of this economic evaluation and limitation on applying these results to other underground transmission applications are presented. ERA

N78-28998# National Technical Information Service, Springfield, Va.
INCINERATIONS STUDIES, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1975 - Mar. 1978
Audrey S. Hundemann Apr. 1978 225 p Supersedes NTIS/PS-77/0330; NTIS/PS-76/0224; NTIS/PS-75/350; COM-73-11437
(NTIS/PS-78/0366/1; NTIS/PS-77/0330; NTIS/PS-76/0224; NTIS/PS-75/350; COM-73-11-437) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Federally-sponsored research on the incineration of municipal, industrial, and agricultural wastes is discussed. Topics cover incinerator design, air pollution control, materials recovery, heat recovery, pyrolysis incineration, and cost studies. (This updated bibliography contains 220 abstracts, 41 of which are new entries to the previous edition.) GRA

N78-28999# National Technical Information Service, Springfield, Va.
INCINERATION STUDIES, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Reports, 1975 - Mar. 1978
Audrey S. Hundemann Apr. 1978 289 p Supersedes NTIS/PS-77/0331; NTIS/PS-76/0226
(NTIS/PS-78/0367/9; NTIS/PS-77/0331; NTIS/PS-76/0226) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Worldwide research on the incineration of municipal, industrial, agricultural, and shipboard wastes is discussed. Topics cover incinerator design, air pollution control, materials recovery, heat recovery, pyrolysis incineration, and cost studies. (This updated bibliography contains 282 abstracts, 78 of which are new entries to the previous edition.) GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N78-29000* National Aeronautics and Space Administration, Washington, D. C.
UNUSUAL SATELLITE DATA: A BLACK HOLE?
8 Aug. 1978 9 p
(NASA-News-Release-78-122; P78-10124) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 03A

Data obtained by the NASA-launched European Space Agency's International Ultraviolet Explorer satellite suggests the possibility of a massive black hole at the center of some globular clusters (star groups) in our galaxy. Six of these clusters, three of them X-ray sources, were closely examined. Onboard short wavelength UV instrumentation penetrated the background denseness of the clusters 15,000 light years away where radiation, probably from a group of 10 to 20 bright blue stars orbiting the core, was observed. The stars may well be orbiting a massive black hole the size of 1,000 solar systems. The existence of the black hole is uncertain. The dynamics of the stars must be studied first to determine how they rotate in relation to the center of

the million-star cluster. This may better indicate what provides the necessary gravitational pull that holds them in orbit. A.R.H.

N78-29001# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE CURRENT STATE OF GEODSS ASTROMETRY
Laurence G. Taff and Iva M Poirier 27 Jan. 1978 33 p refs (Contract F19628-78-C-0002)
(AD-A053248; ETS-30; ESD-TR-78-17) Avail: NTIS HC A03/MF A01 CSCL 03/1

This report summarizes the present status of the implementation of real-time positional data reduction at the GEODSS Experimental Test Site. The report embraces definitions of the various procedures which have been explored, their respective futures, their accuracies and precisions, their source files, and how the operator interacts with these procedures in a computer controlled electro-optical artificial satellite observatory. The Introduction contains references to the documents that describe the underlying philosophy, theoretical and practical foundations, and computational details. Author (GRA)

N78-29002# Itek Corp., Lexington, Mass. Optical Systems Div.
REAL-TIME ATMOSPHERIC MONITOR Final Technical Report, Mar. 1974 - Jan. 1977
Alan MacGovern Griffiss AFB, N. Y. RADC Apr. 1978 38 p refs
(Contract F30602-74-C-0147; ARPA ORDER 2646; AF Proj. 2646)
(AD-A054142; PFR-78-006; RADC-TR-78-80) Avail: NTIS HC A03/MF A01 CSCL 03/1

The most widely accepted measure of the performance of any imaging optical system is the optical transfer function (OTF). The OTF is made up of two functions namely, the modulation transfer function (MTF) and the phase transfer function (PTF), which are simply defined as the modulation and phase of the image of a sinusoidal input object, measured as a function of the spatial frequency of the sinusoid. Ground-based telescopes provide images that are deteriorated by atmospheric turbulence, and the OTF used to describe the performance of the total imaging system must take into account the effects of the atmosphere. The Real Time Atmospheric Measurement (RTAM) system was designed to measure the telescope/atmosphere OTF for the 1.6-meter telescope at the ARPA Maui Optical Station (AMOS) atop Haleakala volcano on the island of Maui, Hawaii. Specifically the instrument was designed to provide multiple short-exposure (.001 second) samples of the system OTF using light from bright stars for making the measurement. This report describes the RTAM instrument developed by Itek Corporation, together with test results. Author (GRA)

N78-29003# Stockholm Observatory (Sweden).
LINEAR POLARIZATION AND K MAGNITUDES OF SELECTED VISUAL DOUBLE STARS
Goesta F. Gahm, Peter K. Lindroos, Andrew D. MacGregor (Imp. Coll. of Sci. and Technol.), Lennart Nordh, and Goeran Olofsson 1976 15 p refs
(Rept-3) Avail: NTIS HC A02/MF A01

Observations of visual binary stars selected on the basis of the age estimated for the primary component are presented. On the assumption that the double (or multiple) stars were physically associated, a fraction of the faint companions were expected to be pre-main-sequence stars. The observations consisted of linear polarization measurements in the blue spectral region, and infrared photometry. The number of stars observed was very limited, and in no case was any obvious pre-main-sequence characteristics revealed. Author (ESA)

N78-29004# Cambridge Univ. (England). Inst. of Astronomy.
[ACTIVITIES OF THE INSTITUTE OF ASTRONOMY] Annual Report, 1976-1977
1977 27 p refs
Avail: NTIS HC A03/MF A01

Summaries are given of stellar and galaxy observations and theory. Instrumentation and public lectures are briefly noted. Personnel are named and staff publications are listed. ESA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N78-29005 New Mexico State Univ., Las Cruces.
AN ANALYSIS OF NUMERICAL INTEGRATION TECHNIQUES FOR THE MODELING OF OPEN GALACTIC CLUSTERS Ph.D. Thesis
Adrian Daniel Herzog 1977 125 p
Avail: Univ. Microfilms Order No. 78-07996

While testing the integration technique, it was found that one of the constants of integration, the energy, was not conserved. This non-conservation of energy produces an enhancement of the evolutionary trends. Therefore, this integration scheme, is not applicable to the problem of integrating individually tailored evolutionary models. Since these individualized models based on the observational data could not be produced, an analysis was done of the errors still inherent in a numerical integration of the N-body problem using Wielen's polynomial technique. It was found that the energy error drives the evolution to form a denser nucleus and a more extended halo than would occur in a real cluster. Dissert. Abstr.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N78-29006*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
LIMB-DARKENING AND THE STRUCTURE OF THE JOVIAN ATMOSPHERE
William I. Newman and Carl Sagan 1978 41 p refs
(Grant NGR-33-010-082)
(NASA-CR-157306; CRSR-689) Avail: NTIS HC A03/MF A01 CSCL 03B

By observing the transit of various cloud features across the Jovian disk, limb-darkening curves were constructed for three regions in the 4.6 to 5.1 mu cm band. Several models currently employed in describing the radiative or dynamical properties of planetary atmospheres are here examined to understand their implications for limb-darkening. The statistical problem of fitting these models to the observed data is reviewed and methods for applying multiple regression analysis are discussed. Analysis of variance techniques are introduced to test the viability of a given physical process as a cause of the observed limb-darkening. L.S.

N78-29007*# National Aeronautics and Space Administration, Washington, D. C.
ASTEROIDS: AN EXPLORATION ASSESSMENT
David Morrison, ed. and William C. Wells, ed. 1978 295 p refs Conf. held at Chicago, 19-21 Jan. 1978
(NASA-CP-2053) Avail: NTIS HC A13/MF A01 CSCL 03B

The current state of asteroid science is assessed. Future space missions to gain more knowledge on asteroid relationship to solar system formation are outlined. For individual titles, see N78-29008 through N78-29026.

N78-29008*# Carnegie Institution of Washington, D. C. Dept. of Terrestrial Magnetism.
DYNAMICAL EVIDENCE REGARDING THE RELATIONSHIP BETWEEN ASTEROIDS AND METEORITES
George W. Wetherill *In* NASA, Washington Asteroids 1978 p 17-35 refs (For primary document see N78-29007 19-91)
Avail: NTIS HC A13/MF A01 CSCL 03B

Meteorites are fragments of small solar system bodies transferring into the vicinity of earth from the inner edge of the asteroid belt. Photometric measurements support an association between Apollo objects and chondritic meteorites. Dynamical

arguments indicate that most Apollo objects are devolatilized comet residues, however; petrographic and cosmogonical reasons argue against this conclusion. G.G.

N78-29009*# Chicago Univ., Ill. Enrico Fermi Inst. and Dept. of Chemistry and Geophysical Sciences.
METEORITES AND THEIR PARENT BODIES: EVIDENCE FROM OXYGEN ISOTOPES
Robert N. Clayton *In* NASA, Washington Asteroids 1978 p 37-43 refs (For primary document see N78-29007 19-91) (Grant NSF EAR-74-19038)
Avail: NTIS HC A13/MF A01 CSCL 03B

Isotopic abundance variations among meteorites are used to establish genetic associations between meteorite classes. Oxygen isotope distributions between group II E irons with H-group ordinary chondrites and enstatic meteorites indicate that the parent bodies were formed out of pre-solar material that was not fully mixed at the time condensation occurred within the solar nebula. G.G.

N78-29010*# Center for Astrophysics, Cambridge, Mass. Center for Astrophysics.
NATURE AND EVOLUTION OF THE METEORITE PARENT BODIES: EVIDENCE FROM PETROLOGY AND METALLURGY
John A. Wood *In* NASA, Washington Asteroids 1978 p 45-55 refs (For primary document see N78-29007 19-91) (Grant NGL-09-015-150)
Avail: NTIS HC A13/MF A01 CSCL 03B

The physical as well as chemical properties of the meteorite parent bodies are reviewed and it is concluded that many differentiated meteorites were likely formed in asteroidal-sized parents. A new model is developed for the formation of pallasites at the interface between an iron core and olivine mantle in differentiated bodies only about 10 km in diameter, which are later incorporated into a second generation of larger (100 km) parent bodies. G.G.

N78-29011*# Chicago Univ., Ill. Enrico Fermi Inst. and Dept. of Chemistry.
MOST STONY METEORITES COME FROM THE ASTEROID BELT
Edward Anders *In* NASA, Washington Asteroids 1978 p 57-75 refs (For primary document see N78-29007 19-91) (Grant NGL-14-001-010)
Avail: NTIS HC A13/MF A01 CSCL 03B

The presence of trapped solar gas in stony meteorites places their origin in the regoliths of asteroidal-type bodies. The most plausible sources are the C (carbonaceous) and S (siliceous) asteroids, in spite of the differences between the spectra of S asteroids and ordinary chondrites. This problem is a central one for the interpretation of both astronomical observations and dynamical theory. Author

N78-29012*# National Aeronautics and Space Administration, Washington, D. C.
PHYSICAL OBSERVATIONS AND TAXONOMY OF ASTEROIDS
David Morrison *In its* Asteroids 1978 p 81-97 refs (For primary document see N78-29007 19-91)
Avail: NTIS HC A13/MF A01 CSCL 03B

Physical asteroid observations are summarized and the classification scheme to describe asteroid surfaces in relation to mineralogical composition is detailed. The principle classes, distinguished on the basis of a number of parameters involving albedo and color, are called C, S, and M. G.G.

N78-29013*# Arizona Univ., Tucson. Lunar and Planetary Lab.
GEOGRAPHY OF THE ASTEROID BELT
Benjamin H. Zellner *In* NASA, Washington Asteroids 1978 p 99-107 refs Sponsored by NASA (For primary document see N78-29007 19-91)
Avail: NTIS HC A13/MF A01 CSCL 03B

The CSM classification serves as the starting point on the geography of the asteroid belt. Raw data on asteroid types are corrected for observational biases (against dark objects, for instance) to derive the distribution of types throughout the belt. Recent work on family members indicates that dynamical families have a true physical relationship, presumably indicating common origin in the breakup of a parent asteroid. G.G.

N78-29014*# Hawaii Univ., Honolulu. Inst. for Astronomy.
ASTEROID SURFACE MINERALOGY: EVIDENCE FROM EARTH-BASED TELESCOPE OBSERVATIONS
Thomas B. McCord *In* NASA, Washington Asteroids 1978 p 109-125 refs (For primary document see N78-29007 19-91)
Avail: NTIS HC A13/MF A01 CSCL 03B

The interpretation of asteroid reflectance spectrophotometry in terms of mineralogical types gives inferred mineral assemblages for about 60 asteroids. Asteroid surface materials are compared with similar materials that make up many meteorites. The absence of asteroids with spectra that match identically the ordinary chondrites is noted. G.G.

N78-29015*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INFRARED OBSERVATIONS OF ASTEROIDS FROM EARTH AND SPACE
Dennis L. Matson, Glenn J. Veeder, and Larry A. Lebofsky (Arizona Univ., Tucson) *In* NASA, Washington Asteroids 1978 p 127-144 refs (For primary document see N78-29007 19-91) (Contract NAS7-100)
Avail: NTIS HC A13/MF A01 CSCL 03B

Infrared reflectances at wavelength between 1 and 4 micrometers are used for determining asteroid surface mineralogy, surface composition, diameters, and albedos. Thermal models were developed for analyzing infrared observations at longer wavelengths. The discovery of a spectral feature due to water of hydration on Ceres seems to contradict the mineralogy inferred from spectrophotometry. G.G.

N78-29016*# Planetary Science Inst., Tucson, Ariz.
ASTEROID COLLISIONS, CRATERS, REGOLITHS, AND LIFETIMES
Clark R. Chapman *In* NASA, Washington Asteroids 1978 p 145-160 refs (For primary document see N78-29007 19-91) (Contract NASw-3096; NASw-2909)
Avail: NTIS HC A13/MF A01 CSCL 03B

Laboratory experiments and computer modeling are used to predict the development of regoliths on all asteroids more than a few tens of kilometers in diameter, allowing for a wide range in the intrinsic strength of asteroidal surface materials. The high frequency of interasteroid collisions requires nearly all asteroids to be fragments of precursors. G.G.

N78-29017*# California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.
EARTH-APPROACHING ASTEROIDS: POPULATIONS, ORIGIN, AND COMPOSITIONAL TYPES
E. M. Shoemaker and E. F. Helin *In* NASA, Washington Asteroids 1978 p 161-175 refs (For primary document see N78-29007 19-91)
Avail: NTIS HC A13/MF A01 CSCL 03B

Origin, physical properties, and discovery history of smaller asteroids are reviewed. They appear to link the main belt objects, namely the comets and meteorites. Physical observations suggest that a wide variety of compositional types are represented among the near-earth asteroids; the apparent rarity of carbonaceous objects is stated. G.G.

N78-29018*# Planetary Science Inst., Tucson, Ariz.
THE ROLE OF EARTH-BASED OBSERVATIONS OF ASTEROIDS DURING THE NEXT DECADE
Clark R. Chapman and Benjamin H. Zellner *In* NASA, Washington Asteroids 1978 p 183-191 refs Prepared jointly with Arizona Univ., Tucson (For primary document see N78-29007 19-91) (PSI-Contrib-99) Avail: NTIS HC A13/MF A01 CSCL 03B

Present reconnaissance studies of asteroids shift ground based programs to more specialized, intensive studies of selected individual bodies and special classes. Two powerful techniques--radar and mid-IR spectroscopy--have yet to be widely applied to asteroids; high priority should be given to: (1) search programs with a large Schmidt telescope (especially for Mars- and Earth-approaching bodies); (2) a moderate resolution visible and near-IR spectrophotometric survey of at least half the asteroids; (3) high resolution spectrophotometry and radiometry of unusual

objects; (4) radar studies of representative main belt asteroids; and (5) application of the full complement of astrophysical techniques to objects of high scientific interest and to potential space mission targets. The infrared astronomical satellite also has high potential for contributing to asteroid science. G.G.

N78-29019*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SCIENCE RATIONALE FOR AN INITIAL ASTEROID-DEDICATED MISSION
Fraser P. Fanale *In* NASA, Washington Asteroids 1978 p 193-206 refs (For primary document see N78-29007 19-91) (Contract NAS7-100)
Avail: NTIS HC A13/MF A01 CSCL 03B

Spacecraft observations of asteroids involve rendezvous or orbit with several main belt asteroids. This concept of a multi-asteroid rendezvous mission provides a baseline for mission planning. G.G.

N78-29020*# Cornell Univ., Ithaca, N. Y. Lab. for Planetary Studies.
IMAGING ASTEROIDS: SOME LESSONS LEARNED FROM THE VIKING INVESTIGATION OF PHOBOS AND DEIMOS
Joseph Veverka *In* NASA, Washington Asteroids 1978 p 207-223 refs (For primary document see N78-29007 19-91) (Grant NsG-7156)
Avail: NTIS HC A13/MF A01 CSCL 03B

Specific experiences from the study of Phobos and Deimos during the Viking mission are used to formulate three basic goals for imaging studies of asteroids. These are: (1) the highest possible resolution; (2) complete coverage of the surface; and (3) data over a wide range of phase angles. G.G.

N78-29021*# Science Applications, Inc., Schaumburg, Ill.
ASTEROID MISSION ALTERNATIVES
John C. Niehoff *In* NASA, Washington Asteroids 1978 p 225-244 refs (For primary document see N78-29007 19-91)
Avail: NTIS HC A13/MF A01 CSCL 03B

The options for asteroid missions are evaluated within the constraints of existing or planned launch vehicles and low-thrust propulsion systems. A wide variety of missions is possible, including flyby, rendezvous, and even sample return. The multi-asteroid rendezvous concept requires an ion drive low-thrust propulsion system of the type being developed for a comet rendezvous. It is indicated that there are plentiful opportunities for such missions to visit four asteroids with stay times of 60-90 days each and with transit times between rendezvous of the order of a year. G.G.

N78-29022*# California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.
EARTH-APPROACHING ASTEROIDS AS TARGETS FOR EXPLORATION
E. M. Shoemaker and E. F. Helin *In* NASA, Washington Asteroids 1978 p 245-256 refs (For primary document see N78-29007 19-91)
Avail: NTIS HC A13/MF A01 CSCL 03B

A mission strategy focused on the earth approaching asteroids is presented. The opportunities for sample return and manned visits favor the closer Apollos and Amors over the main belt objects. G.G.

N78-29023*# Hawaii Univ., Honolulu. Inst. for Astronomy.
OPTICAL REMOTE SENSING OF ASTEROID SURFACES FROM SPACECRAFT
Thomas B. McCord *In* NASA, Washington Asteroids 1978 p 265-273 refs (For primary document see N78-29007 19-91)
Avail: NTIS HC A13/MF A01 CSCL 03B

Reflectance spectroscopy and multispectral mapping are the techniques likely to be most useful for determining asteroid surfaces. Several other techniques should be considered for providing complementary information. G.G.

N78-29024*# California Univ., San Diego.
REMOTE GEOCHEMICAL SENSING OF ASTEROIDS
James R. Arnold *In* NASA, Washington Asteroids 1978 p 275-278 refs (For primary document see N78-29007 19-91)
Avail: NTIS HC A13/MF A01 CSCL 03B

Remote geochemical measurements with gamma-ray spectrometers and X-ray fluorescence spectrometers are discussed. These instruments have proved themselves in lunar orbit, and seem best suited to determining the elemental content of asteroid surfaces. G.G.

N78-29025*# Cornell Univ., Ithaca, N. Y. Lab. for Planetary Studies.
SOME IMPORTANT IMAGING GOALS FOR ASTEROID MISSIONS
Joseph Veverka *In* NASA, Washington Asteroids 1978 p 279-284 refs (For primary document see N78-29007 19-91) (Grant NsG-7156)
Avail: NTIS HC A13/MF A01 CSCL 03B

Very high resolution imaging provides the best means of examining geological processes acting on asteroid surfaces. Imaging also may be important for revealing how asteroids accreted and for obtaining some data on their differentiation history. Imaging from rendezvous together with Doppler tracking is the only way to determine accurate densities and hence place limits on bulk composition. G.G.

N78-29026*# Chicago Univ., Ill. Enrico Fermi Institute and Dept. of Chemistry.
EXPERIMENTS ON ASTEROIDS USING HARD LANDERS
Anthony Turkevich and Thanasis Economou *In* NASA, Washington Asteroids 1978 p 285-292 refs Prepared in cooperation with California Inst. of Technol., Pasadena (For primary document see N78-29007 19-91)
Avail: NTIS HC A13/MF A01 CSCL 03B

Hard lander missions to asteroids are examined using the Westphal penetrator study as a basis. Imagery and chemical information are considered to be the most significant science to be obtained. The latter, particularly a detailed chemical analysis performed on an uncontaminated sample, may answer questions about the relationships of asteroids to meteorites and the place of asteroids in theories of the formation of the solar system.G.G

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N78-29027*# Stanford Univ., Calif. Inst. for Plasma Research.
A STUDY OF LARGE-SCALE SOLAR MAGNETIC AND VELOCITY FIELDS
Thomas Lee Duvall, Jr. Dec. 1977 122 p refs Sponsored in part by the Fleischmann (Max C.) Foundation
(Grant NGR-05-020-559; Contract N00014-75-C-0207; Grants NSF ATM-74-19007; NSF DES-75-15664)
(NASA-CR-157321; SU-IPR-724) Avail: NTIS HC A06/MF A01 CSCL 03B

Magnetograms are used to derive the average poloidal and toroidal components of the photospheric magnetic field near solar minimum as a function of the poloidal field near the poles is found to have the dipolar structure characteristic of solar minimum with a positive field in the north and negative field in the south, both with a measured strength of approximately 1 gauss. At lower latitudes the poloidal field has the same polarity as the pole in that hemisphere but the field strength has the reduced magnitude of approximately 0.1 gauss. A toroidal field of broad latitude extent is found to have opposite sense in the two solar hemispheres and a magnitude of approximately 0.1 gauss. The sense of the toroidal field is the same as that of the assumed subsurface toroidal field giving rise to active regions solar cycle 21. The toroidal field is used to derive the electric current crossing the photosphere in conjunction with the magnetogram observations, an accurate determination of the relative wavelength shift of the spectral line is made for each position on the solar disk. The solar rotation, the limb effect on the disk and the possibility of a mean meridional circulation in the photosphere are studied. G.G.

N78-29028*# Stanford Univ., Calif. Inst. for Plasma Research.
A PHYSICAL MECHANISM FOR THE PREDICTION OF THE

SUNSPOT NUMBER DURING SOLAR CYCLE 21
K. H. Schatten, P. H. Scherrer, L. Svalgaard, and J. M. Wilcox Feb. 1978 13 p refs Submitted for publication. Sponsored in part by the Max C. Fleischmann Found.
(Grant NGR-05-020-559; Contract N00014-76-C-0207; Grant NSF ATM-77-20580)
(NASA-CR-157320; SU-IPR-736) Avail: NTIS HC A02/MF A01 CSCL 03B

On physical grounds it is suggested that the sun's polar field strength near a solar minimum is closely related to the following cycle's solar activity. Four methods of estimating the sun's polar magnetic field strength near solar minimum are employed to provide an estimate of cycle 21's yearly mean sunspot number at solar maximum of 140 plus or minus 20. This estimate is considered to be a first order attempt to predict the cycle's activity using one parameter of physical importance. A.R.H.

N78-29029*# Stanford Univ., Calif. Inst. for Plasma Research.
THE STRENGTH OF THE SUN'S POLAR FIELDS
Leif Svalgaard, Thomas L. Duvall, Jr., and P. H. Scherrer Jan. 1978 22 p refs
(Grant NGR-05-020-559; Contract N00014-76-C-0207; Grant NSF ATM-77-20580)
(NASA-CR-157335; SU-IPR-737) Avail: NTIS HC A02/MF A01 CSCL 03B

Observations at Stanford Solar Observatory of solar magnetic fields in the FeI line lambda 525.02 nm shows that a radial magnetic field measured at a point where the radius makes an angle rho with the line of sight is observed to be decreased by a factor cos rho. For field elements of 150 mT, magnetograph saturation causes the measured field to be too low by a factor of 1.8. The average field magnitude poleward 55 deg latitude is measured to be near 100 micron T. Variation of the apparent field over a 3 arc min aperture grazing the limb at central meridian amounts to a factor of two over the year; the field being strongest when the pole is tipped the most (7 1/4 deg) towards the observer. Combination of all the above results leads to the following picture of the magnetic field within the polar caps. The field is nearly radial, varying as B sub p cos to the 8th power theta where the field strength B sub p at the pole (theta = 0 deg) is 1.15 mT, and falling off to below 0.2 mT at the polar cap boundary (theta = 35 deg). Within coronal holes outside of the polar cap the magnetic field strength at sunspot minimum is rather small (0.15 mT). Author

N78-29030# Lockheed Missiles and Space Co., Palo Alto, Calif.
SOLAR MAGNETIC FIELDS STUDY Final Report, 28 Mar. - 30 Sep. 1977
Robert C. Smithson and Alan M. Title 31 Oct. 1977 20 p refs
(Contract F19628-77-C-0128)
(AD-A051137; LMSC-D567280; AFGL-TR-77-0249) Avail: NTIS HC A02/MF A01 CSCL 03/2

High resolution observations of quiet sun magnetic fields have been made at Sacramento Peak Observatory using the Lockheed Universal Filter. The existence of 'salt and pepper' fields described by other observers has been called into question. Author (GRA)

N78-28502# National Oceanic and Atmospheric Administration, Silver Spring, Md.
MONITORING SOLAR RADIATION FOR SOLAR ENERGY
Lester Machta *In* WMO Solar Energy 1977 p 1-35 refs (For primary document see N78-28501 19-42)
(Grant NSF AFR-75-17303)
Avail: NTIS HC A99/MF A01

N78-28506# Hamburger Sternwarte (West Germany).
VARIATION OF SOLAR AND TERRESTRIAL RADIATION WITH TIME OF THE DAY AND TIME OF THE YEAR AS DEDUCED FROM MANY YEARS RECORDS
F. Kasten *In* WMO Solar Energy 1977 p 80-88 (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28507# Singapore Univ.
SOLAR RADIATION MODEL BUILDING WITH DATA OF NON-UNIFORM RELIABILITY AND COMPLETENESS
T. N. Goh and K. J. Tan *In* WMO Solar Energy 1977 p 89-99 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28508# World Meteorological Organization, Geneva (Switzerland).
THE AVAILABILITY OF SOLAR ENERGY AT THE EASTERN MEDITERRANEAN
A. Manes and A. Teitelman *In its* Solar Energy 1977 p 100-113 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28509# World Meteorological Organization, Geneva (Switzerland).
A DETAILED STUDY OF SOLAR RADIATION AND POTENTIAL PHOTOSYNTHESIS
G. O. P. Obasi and N. N. P Rao *In its* Solar Energy 1977 p 114-124 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28510# World Meteorological Organization, Geneva (Switzerland).
RADIATION MEASUREMENTS FOR SOLAR ENERGY APPLICATIONS
Anna Mani *In its* Solar Energy 1977 p 125-143 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28511# World Meteorological Organization, Geneva (Switzerland).
FIRST RESULTS OBTAINED FROM THE SWISS MOBILE SYSTEM FOR SOLAR RADIATION MEASUREMENTS
A. Heimo and P. Valko *In its* Solar Energy 1977 p 144-152 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28512# World Meteorological Organization, Geneva (Switzerland).
SOLARIMETRY BY SATELLITES IN THE AMAZON REGION
A. W. AlbinodeSousa *In its* Solar Energy 1977 p 153-161 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28513# Universidad Nacional Autonoma de Mexico, Villa Obregon.
ON THE NUMERICAL COMPUTATION OF SOLAR RADIATION PARAMETERS FROM SATELLITE CLOUD DATA
E. Hernandez *In* WMO Solar Energy 1977 p 162-170 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28514# International Institute for Applied Systems Analysis, Laxenburg (Austria).
DIRECT RADIATION DATA FORMULATION FROM GLOBAL RADIATION AND OTHER GIVEN MEASUREMENTS, USING A COMPUTER AIDED METHOD
N. Weyss *In* WMO Solar Energy 1977 p 171-181 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

N78-28517 World Meteorological Organization, Geneva (Switzerland).
MATHEMATICAL APPROXIMATIVE EQUATIONS FOR SOLAR RADIATION INCIDENTAL TO A DETERMINED SITE
Julio R. Hirschmann *In its* Solar Energy 1977 p 198-209 refs (For primary document see N78-28501 19-42)
Avail: NTIS HC A99/MF A01

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N78-29031*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.

THE CHARGE AND ENERGY SPECTRA OF HEAVY COSMIC RAY NUCLEI

W. R. Scarlett, Phyllis S. Freier, and Jake C. Waddington Jul. 1978 25 p refs

(Grant NGR-25-005-050)

(NASA-CR-157345; CPTR-177) Avail: NTIS HC A02/MF A01 CSCL 03B

A charged particle detector array flown in a high altitude balloon detected and measured some 30,000 cosmic ray nuclei with Z greater than or equal to 12. The charge spectrum at the top of the atmosphere for nuclei with E greater than 650 MeV/n and the energy spectrum for 650 less than or equal to E less than 1800 MeV/n are reported and compared with previously published results. The charge spectrum at the source of cosmic rays is deduced from these data and compared with a recent compilation of galactic abundances. Author

99 GENERAL

N78-29032# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 41

20 Jul. 1978 101 p refs Transl. into ENGLISH from various Russian journals

(JPRS-71512) Copyright. Avail: NTIS HC A06/MF A01

Soviet progress is reported in automation technology, industrial robot use and development, and in satellite observations of earth resources. Oceanographic studies of atmospheric circulation above the Pacific Ocean, and the tectonic structure of its bottom are included. For individual titles, see N78-29033 through N78-29040.

N78-29033# Joint Publications Research Service, Arlington, Va.

PROGRESS WITH AUTOMATED SYSTEMS REPORTED **c60**

D. G. Zhimerin *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 18-23 Transl. into ENGLISH from Ekon. Gazeta (USSR), no. 33, May 1978 p 7 (For primary document see N78-29032 19-99)

Copyright. Avail: NTIS HC A06/MF A01

The application of computer technology and automated control systems in the Soviet economy is reviewed. The tasks required to increase their efficiency include the development of standard programs and standard designs for collective-use computing centers and control systems, and the production and distribution of improved third generation Ryad-type computers. A.R.H.

N78-29034# Joint Publications Research Service, Arlington, Va.

MORE EFFICIENT COST-ACCOUNTING MANAGEMENT WITH ELECTRONIC COMPUTERS **c60**

K. Kozub *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 33-36 Transl. into ENGLISH from Pravda (Moscow), 22 May 1978 p 2 (For primary document see N78-29032 19-99)

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Managers of large modern plants cannot rely merely on experience and right thinking when making decisions. A quantity of various data must be obtained and analyzed. Electronic computers and automatic control systems are also required. To insure efficient use of data processing equipment, data from various consoles must be transmitted by communication channels (telephone and telegraph) for primary processing by upper level branch automatic control systems. An interdepartmental accounting service is proposed for assuring complete use of machine time by considering the possibilities of departmental computer centers and their software requirements, and then assigning various computer tasks to specific centers in order to eliminate duplication of programs. A.R.H.

N78-29035# Joint Publications Research Service, Arlington, Va.

DIRECTIONS OF EFFECTIVE DEVELOPMENT OF COMPUTER SOFTWARE **c61**

Ivan Todorov *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 37-40 ref Transl. into ENGLISH from Mekh. Avtomatiz. Proizv. (Moscow), no. 4, 1978 p 54-55 (For primary document see N78-29032 19-99)

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Multiprogramming is an important condition for the accelerated creation and increased efficiency of automated information processing systems. The status of computer programming in Bulgaria is explored and suggestions are given for more effective use of personnel in program development. Complex unification, standardization, and classification by types eliminates ineffective programs and reduces labor costs. A.R.H.

N78-29036# Joint Publications Research Service, Arlington, Va.

ROBOT PRODUCTION, USE DISCUSSED **c31**

Ye. Yurevich and M. I. Kalinin *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 48-52 Transl. into ENGLISH from Leningr. Pravda (USSR), 21 May 1978 p 2 (For primary document see N78-29032 19-99)

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More than 230 robots are in use in various Leningrad industries. A coordinating council was established to oversee the development, production, and introduction of automatic manipulators for improved working conditions. Technical problems which must be solved to comply with plans for the next five years are the construction of five types of automatic manipulators and the development of standardization electronic modules for mass production. A.R.H.

N78-29037# Joint Publications Research Service, Arlington, Va.

TWO-DIMENSIONAL LINEAR MODELS OF TWO-LEGGED WALKING **c54**

V. V. Beletskiy and T. S. Kirsanova *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 53-68 refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Tverdogo Tela (Moscow), no. 4, 1976 p 51-62 (For primary document see N78-29032 19-99)

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Analytical modeling of the motion of two-legged walking apparatus is described. The semi-reverse method is used. Solutions of the equations of motion are found in explicit analytical form on the assumption that the legs and body of the apparatus make small two-dimensional oscillations. Author

N78-29038# Joint Publications Research Service, Arlington, Va.

SPACE PHOTOGRAPHY FEATS, OBJECTIVES DESCRIBED **c43**

Yuriy Zaytsev *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 70-73 Transl. into ENGLISH from Kierunki (Warsaw), no. 27, 2 Jul. 1978 p 3 (For primary document see N78-29032 19-99)

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Applications of space technology methods in geology, oceanography, hydrology, geobotany, soil science, agrobiology, and forestry are reviewed. The problem of finding various natural resources on earth and of studying phenomena occurring in nature is considered. The basic material for spacebased research of earth resources is either black and white or colored photographs. However, if photographs in the visible part of the spectrum and in the light from infrared radiation are made at the same time, the properties of the objects observed can be better investigated. Irradiation measurements of other wavelengths are also important.

By determining the radio temperature of various sectors of the earth's surface, deep-lying layers of the earth's crust may be observed. A.R.H.

N78-29039# Joint Publications Research Service, Arlington, Va.

ATMOSPHERIC PROCESSES ABOVE THE PACIFIC OCEAN **c47**

V. S. Samoylenko *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 74-84 Transl. into ENGLISH from Zemlya Vselennaya (Moscow), no. 3, 1978 p 6-11 (For primary document see N78-29032 19-99)

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Meteorological processes occurring above the Pacific Ocean are discussed with emphasis on the scales of atmospheric circulation. Although all the air masses have purely ocean properties, they differ sharply from each other. Between the various air masses highly extended and sharply defined atmospheric fronts occur contantly. On these fronts, numerous deep atmospheric disturbances develop, are freely propagated, and constantly interact with each other. Topics covered include atmospheric circulation, air masses, frontal areas; the wind field and its effect on the ocean; heat balance, heat cycle, and hydrological cycle. Charts are included. A.R.H.

N78-29040# Joint Publications Research Service, Arlington, Va.

GEOMORPHOLOGY AND TECTONICS OF THE PACIFIC OCEAN FLOOR **c48**

G. P. Udintsev *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 85-93 Transl. into ENGLISH from Zemlya Vselennaya (Moscow), no. 3, 1978 p 12-17 (For primary document see N78-29032 19-99)

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The history of Soviet exploration of the Pacific Ocean bottom is summarized, and the instruments used and maps developed are described. Characteristics of the nonuniform structure of the ocean floor discussed include: deep water trenches of the archipelago systems, arched uplifts and swells within the limits of the oceanic plates, mid-ocean ridges, fracture zones, and drift zones. Schematics and photographs are included. A.R.H.

N78-29041# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 592

13 Jul. 1978 28 p Transl. into ENGLISH from various Eastern European documents

(JPRS-71458) Avail: NTIS HC A03/MF A01

Automation and robot research are discussed, and the activities of the Polish Academy of Science were reported. For individual titles, see N78-29042 through N78-29043.

N78-29042# Joint Publications Research Service, Arlington, Va.

INSTITUTE HEAD DISCUSSES AUTOMATION, ROBOT RESEARCH **c31**

Ivan Berenyi *In its* Transl. on Eastern Europe: Sci. Affairs, No. 592 (JPRS-71458) 13 Jul. 1978 p 1-5 Transl. into ENGLISH from Zero un Informatique (Paris), 22 May 1978 p 8-9 (For primary document see N78-29041 19-99)

Avail: NTIS HC A03/MF A01

A discussion on robotics research and the differences between the East and West is presented. Usage of artificial intelligence in the application of processing controls to deal with situations where there is a sudden breakdown or a panic was investigated. B.B.

N78-29043# Joint Publications Research Service, Arlington, Va.

POLISH ACADEMY OF SCIENCE ACTIVITIES, PERSONNEL

In its Transl. on Eastern Europe: Sci. Affairs, No. 592 (JPRS-71458) 13 Jul. 1978 p 6-16 Transl. into ENGLISH from Nauka Polska (Warsaw), no. 3-4, Mar. - Apr. 1978 p 216-241 (For primary document see N78-29041 19-99)

Avail: NTIS HC A03/MF A01

A theoretical analysis was made and model research and construction designs for anti-acoustic screens were completed. Principles were also developed for using these screens for the needs of industry. B.B.

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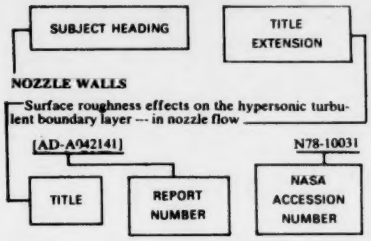

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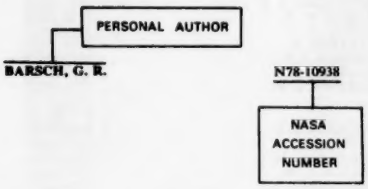

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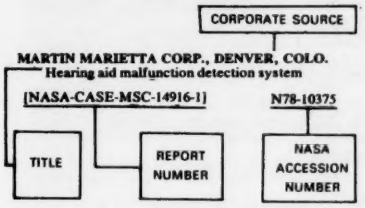

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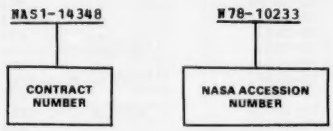

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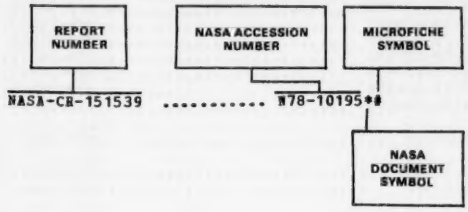

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